

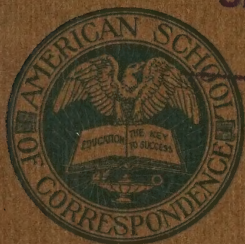
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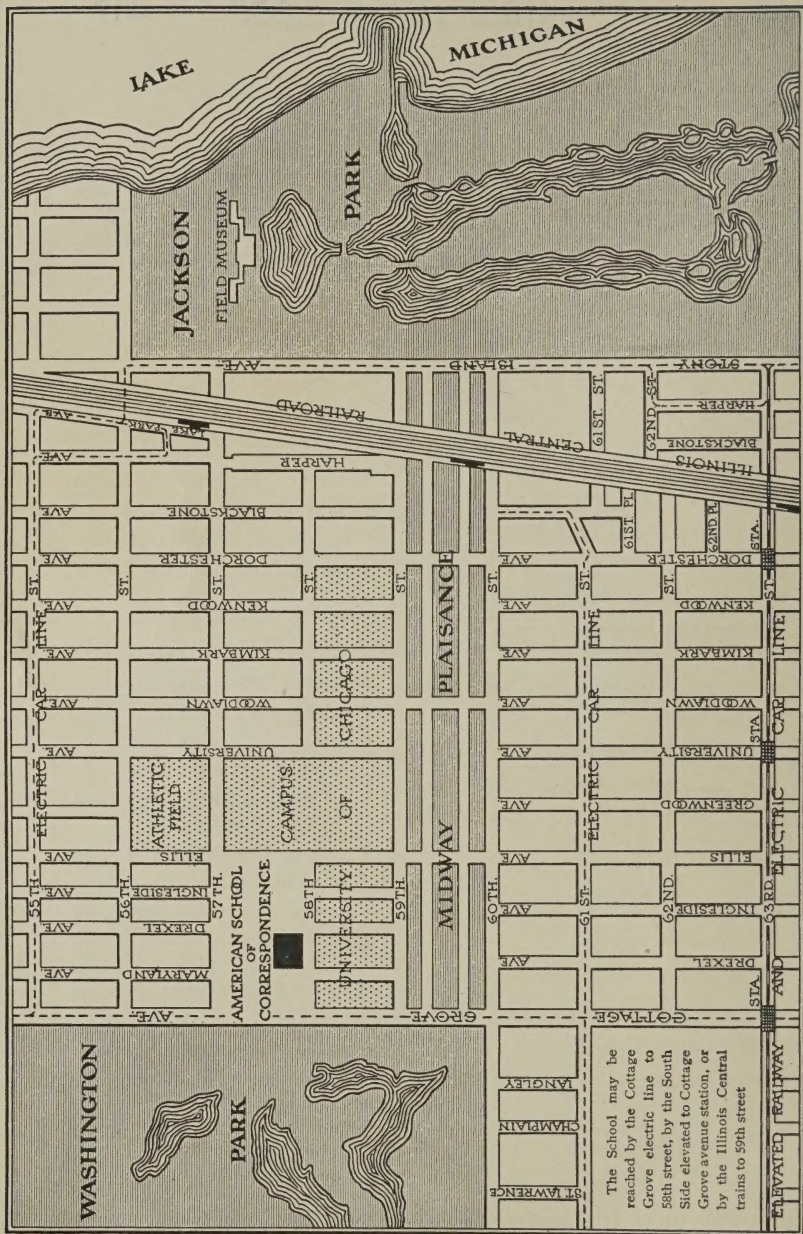
EDUCATION

IT is no disgrace to be poor; it is sometimes a disgrace to be rich; it is always a disgrace to be ignorant. Ignorance implies not lack of opportunity, but lack of ambition. A good education is a guarantee of a man's willingness to work, and his ability to accomplish. There is no royal road to learning; every step of the way must be won by hard, sweaty labor. But an education is worth every effort that it takes—not for the mere dollars and cents that it will bring, but for the power that it gives a man to get and enjoy the best things in life.

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Map of Chicago in the Vicinity of the American School of Correspondence

**GENERAL
INFORMATION**

General Information

A BIT OF HISTORY

THE American School of Correspondence was founded in Boston in 1897, as an "institution of learning" under a charter from the Commonwealth of Massachusetts. Its early work was conducted with the advice and assistance of instructors of Massachusetts Institute of Technology and Harvard University; thus at the beginning it set the high educational standard which it has since maintained. In

Beginning 1902 the School became associated with Armour Institute of Technology at Chicago, and for five years conducted its work in co-operation with that institution. In 1907, having outgrown its quarters, the School erected, in the neighborhood adjacent to The University of Chicago, its present administration building, especially designed for correspondence work.

An early announcement of the School states that it was "founded to meet a general demand among engineers and machinists for a strictly technical school furnishing the highest

Development grade of instruction in steam and electrical engineering and machine shop practice"; and made considerable of the fact that it did not attempt to "teach everything." The School originally offered only six courses; but the immediate success of its work brought it more than 7,000 students the first year, and necessitated the gradual broadening of its scope. In 1901 it began to offer courses in subjects allied with the original six, and to list special courses in general subjects; and in 1903 it gathered its scattered courses into definite Departments. Since then it has made other important additions to its curriculum, including Departments of Law, Commerce, and Fire Insurance; but it has always maintained its original belief that some subjects cannot be successfully taught by mail.

Today the American School offers almost a hundred different courses, and gives instruction in every part of the English-speaking world; it numbers its students by the tens of thousands, and its

graduates by the thousands. It stands pre-eminent in the high class of students that it enrolls, the thorough instruction that it offers, the practical success of its graduates, and the number and position of the well known men—

Present

employers, pastors, educators, engineers, lawyers and business men—who are glad to recommend the School, and to forward its work. It has succeeded because it has been true to its principles of giving its students the instruction for which they enrolled, and depending upon its usefulness for its growth.

PRINCIPLES AND AIMS

THE American School of Correspondence is based upon the principles that every man is entitled to a good education, and that, if he cannot go to school, the school should go to him. It encourages every man to make the most of his opportunities by improving his spare time, and shows him in a practical way how to do it. It has made correspondence

Education for All study so practical that its students graduate from their studies into well paid positions, and has put its courses within the reach of any man who possesses ambition and the will to work. It has gained the good will and the practical encouragement of many of the most successful men in the professions which it teaches, and of employers and business men throughout the country.

The School draws its students from both sexes, from all ages, and from all walks of life. It has on its rolls college and technical school graduates and professors. It has boys and girls in their middle 'teens, and men of fifty and sixty. It draws principally, however, from young men and women of the great middle class, who realize the necessity of a good education, but who are unable to attend resident schools.

A man values a thing according to what it costs him. It is said repeatedly, and with considerable truth, that the man who works his way through college gets more real good out of his college course than the man who merely has to ask for what money he wants.

Working for an Education An overwhelming majority of correspondence students pay their own expenses, either by working a little harder or by living a little closer; and practically all of them make many sacrifices in order to get the time for their studies. When one considers their enthusiasm, the odds that they have overcome, the great things that they have accomplished, and their constantly increasing numbers, he must believe that the correspondence school occupies a useful and honorable place in the educational world.

BUILDING AND LOCATION

THE Administration Building of the School is worthy of particular mention, as it is a concrete expression of the growth and success of the School. It is a four-story and basement structure, built of red pressed brick with gray stone trimmings, and a roof of green tile. It is about twice the size of the average

Building

high school building, but it holds no students—the space is occupied by officers, instructors, and by the many persons required to carry on the affairs of the School. The printing and binding of the School's special texts, bulletins, and supplementary matter, are done outside the Administration Building.

The building is equipped throughout with every modern device for facilitating the work of the School. An inside telephone system puts each man into instant communication with

Conveniences

any other man or Department; a half hourly messenger service brings him his mail, or relieves him of what he has completed; the outgoing mail is sent hourly to the post office. As a further means to facilitate work, the School maintains many conveniences for the comfort and physical well-being of its force. Among these are a free circulating library containing approximately 1,000 volumes of current fiction of the better class; free umbrellas when a sudden shower comes up at closing time; a wholesome, "home-cooked" luncheon at exactly what it costs to prepare; a comfortable lunch room, and free tea and coffee, for young women stenographers and clerks who bring their own lunches.

The School is located seven miles from the City Hall, in the old Hyde Park district of Chicago's great South Side, as shown in the map on page 4. One block west is Wash-

Location

ington Park; one block south is the Midway Plaisance of the World's Columbian Exposition, now a part of the South Park boulevard system; two blocks east is the campus of The University of Chicago. This situation, away from the distractions of the busy "down town" center, and miles from factories, insures the quiet and clear air necessary for the proper conduct of educational work.

ORGANIZATION AND PERSONNEL

THE American School of Correspondence is chartered under the same laws as a State University. It is conducted as an educational institution, for the benefit of its students; not as a commercial enterprise, for the benefit of stockholders. The general conduct of the School is vested in the Board of

Trustees and Cabinet

Trustees, of which the President is *ex officio* the head. This Board determines the general policies of the School, both educational and financial. In its educational work it has the assistance and counsel of an Advisory Board, comprising men who represent many different lines of work, and who have been chosen because of their high standing in their respective professions. The actual conduct of the School is in the hands of the Cabinet, comprising the President, Secretary, Treasurer, and the heads of the five big Departments into which the School is divided for administrative purposes.

The American School staff comprises, as officers, instructors, and editors, men who have been graduated from the best known universities and technical schools in the country, or who have gained their knowledge by years of practical experience. The President received his Ph. B. and A. M. degrees from Oberlin College, and his LL.

Instruction Department

B. degree from Harvard University; the Secretary and Educational Director took his B. S. degree at the University of Illinois, and his Ph. D. degree at the University of Chicago; the other executives have received long and careful training in the "school of experience," and have attained their present positions in the American School after years of efficient service as administrators. The School employs as instructors men only, as they alone have the training and the broad understanding of the personal instruction necessary in correspondence teaching. All of them are either college graduates, or men of long practical experience in their particular lines. Many of them are conducting classes in the neighboring resident schools and universities. Others have proved their teaching ability by the authorship of textbooks which are in current use in both resident and correspondence schools. While the School offers no regular classroom work, students may consult their instructors personally by calling at the School.

The Extension Department has general charge of the student body, both before enrollment, during active membership, and after graduation, except in matters concerned directly with instruction. It performs many of the duties which devolve upon the dean of a resident school; in this capacity it prepares booklets of information and inspiration, answers inquiries regarding terms and courses, discusses with prospective students the proper course to secure the training desired, and handles the inquiries and passes on the applications of persons who have been interested by the School's advertising, or recommended to the School by satisfied students, and by men of influence who appreciate what the School is doing. The effort of this Department is directed toward devising plans to make the work of the School more practical, and its students more efficient.

The textbooks used in its courses are written especially for the School by men highly regarded in their respective fields. Among them are expert practicing and consulting engineers, leading members of the American bench and bar, expert public accountants, managers of great businesses, recognized specialists in fire insurance organization and practice, and prominent members of the faculties of the great American colleges and universities—a grand total of more than two hundred writers. For the production of these textbooks, and other printed matter necessary to its work, the School maintains a corps of experienced editors, proof readers, etc. A new textbook can be placed in the hands of the student within thirty days from the time the manuscript is received from the author; yet this Department is working continuously to get out new texts and to revise the old ones that cover the various subjects taught by the School, now almost five hundred in number.

The financial affairs of the School are in charge of the Treasurer, who is also head of the Accounting Department. This Department is charged with the collection of the thousands of students' accounts, and does the bookkeeping which results from the fact that most students find it easier to pay for their courses on the monthly installment plan. The School employs no collectors; it conducts its business with its students, like its instruction, by mail.

This Department also keeps the records and statistics of the School, and receives and distributes all incoming mail.

The duty of the Publicity Department is to make the American School so well and so favorably known that it shall be impossible for any one to think of correspondence instruction without thinking of the American School as its chief exponent. This Department designs, prepares, and places all advertisements of the School that appear in magazines and newspapers. It has been said that the announcements of the American School prove that an educational institution can advertise effectively, and still maintain the dignity expected of an institution of learning.

In addition to the five chief administrative branches described above, there are the Record, Stenographic, Mailing, and Shipping Departments, which, as their titles suggest, are concerned chiefly with the handling of the mail, and general office work. The School is second only to the great Chicago mail order houses in the volume of mail matter that it handles; yet ninety per cent of the communications received from students and inquirers are answered within twenty-four hours. To make this possible requires a large force of stenographers; while the Mailing Department has electric-driven machines capable of printing, folding, sealing, stamping and tying 5,000 letters an hour. In addition, it mails each day thousands of Bulletins and booklets, textbooks, drawings, and corrected examinations. Altogether the School receives and sends much more mail than is handled by many a postoffice serving a town of 20,000 inhabitants.

The photographs reproduced on other pages show that the several Departments of the School require a large operating force. During the greater part of the year the number averages 250 people; this force is reduced during the summer months, when both students and inquirers show less interest in study. While the School is conducted by men for men, with men instructors, it employs many young women in the various lines that they have made peculiarly theirs—stenographers, typists, checkers, bookkeepers, file clerks, addressers, mail clerks, etc.



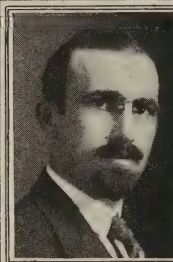
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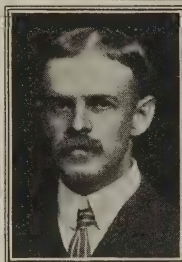
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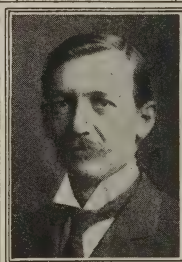
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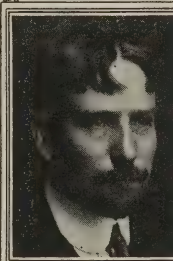
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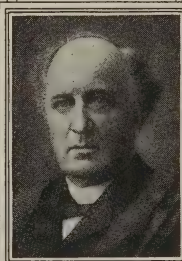
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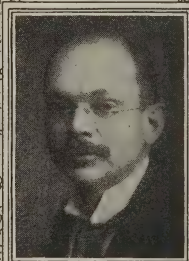
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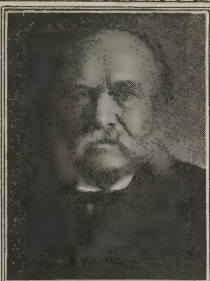
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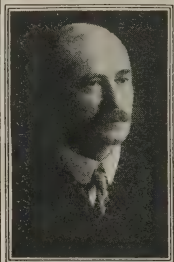
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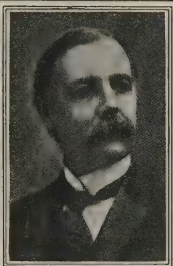
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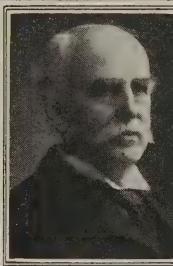
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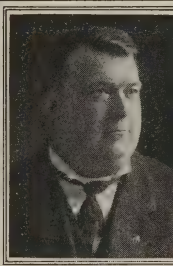
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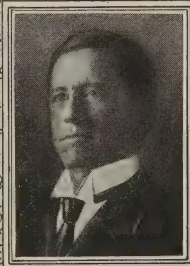
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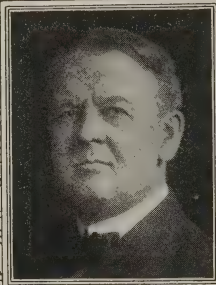
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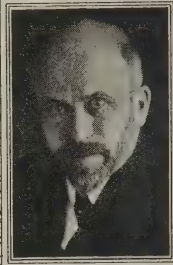
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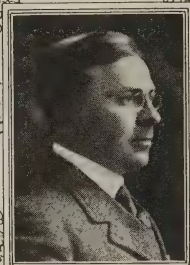
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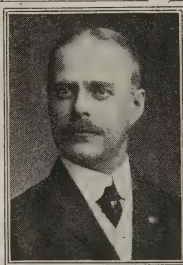
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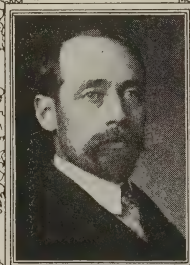
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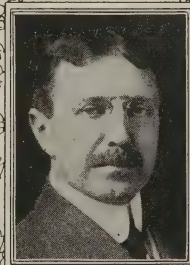
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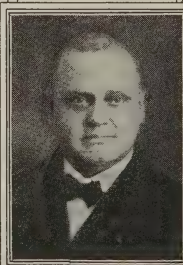
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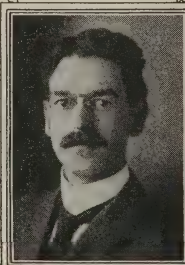
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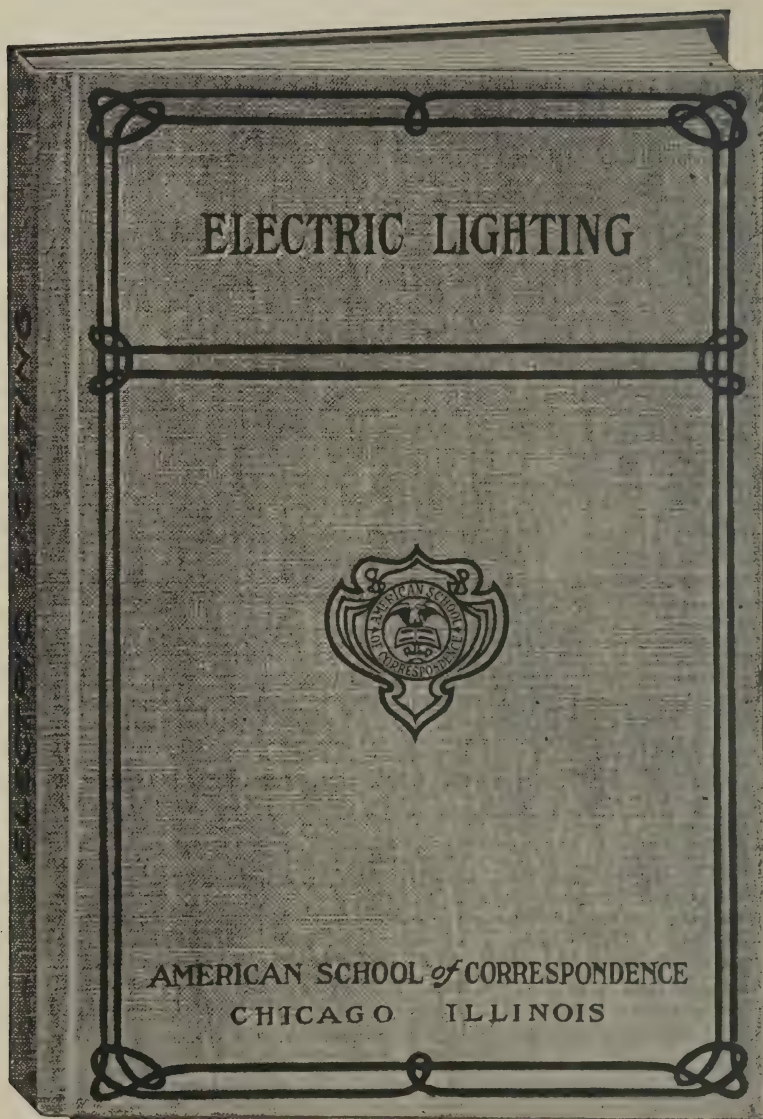
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Instruction

In case he meets with some problem or principle which is not quite clear, he uses the inquiry blank

to state his difficulty, and the instructor gives him a detailed explanation of the vexing point. The School places no limit upon the number of such inquiries that a student may make; except that he is not allowed to make any inquiry on examination questions. These inquiries correspond to the personal help which the resident school student receives from his instructor. The student is also entitled to special advice on problems and questions which may arise in his everyday work, whether or no they are covered by the course which he is taking. This assistance is of great value to the young man who is working and studying at the same time; and to the more advanced man who is taking special work, and can thus get expert advice on any related subject taught by the School. This consulting privilege is continued in force during the life of the graduate.

Upon enrolling, the student is sent the first three or four instruction books, with instructions for their use, inquiry blanks, and such information as he may need to start him

How the Work Is Conducted

right. He is also given a Study Record card for each book, which he is asked to fill out and return with his examination, both as an accu-

rate record of the actual time that he is studying, and as a guide to his instructor in determining the ability of the student to absorb knowledge. Each instruction book contains in the back a series of questions, which the student is required to answer from his own knowledge, as his examination on that particular subject. Each time that he submits a satisfactory examination, he is sent the next instruction book in his course, so that he always has on hand two or three instruction books ahead of the one on which he is working, and is not liable to delay or loss of time through the time taken to get the book to him, or the possible miscarriage of

the mails. The student is supplied with up-to-date instruction books as fast as he is ready for them; but he is never sent a complete set of instruction books upon enrollment, whether or no he pays cash down. He is required to take up the subjects in the order in which they are listed, as by this arrangement he is certain to get first the elementary subjects which are prerequisite to more advanced work. In the Engineering courses, however, Mechanical Drawing may be taken any time after the completion of Practical Mathematics and Practical Physics.

The student's examination reaches the School in a mail sack containing hundreds of other examinations and inquiries from all over the world. This mail is opened in the

Handling Examinations

Accounting Department by a mail clerk; in case the student has sent in a remittance on tuition, or for some special purchase which he wishes the School to make for him, the amount is noted on the letter, or on the examination itself, and entered to the student's credit on the Daily Cash Book. The examination is referred to the Record Department, where it is identified by clipping to it the student's record card and the folder containing all correspondence that the School has had with him. Thence it goes to the Instruction Department, to the desk of the head of the department of study in which the student is engaged, and is referred by him to the instructor best fitted to handle it. When the instructor has corrected and graded it, it is returned to the Record Department, where the grade is recorded, the student card and correspondence detached and returned to the files, the Certificate of Examination written, and the next textbook ordered sent. Thence the examination goes to the Mailing Department, to be enveloped, sealed, stamped, and sent on its way back to the student, usually within twenty-four hours from the time it was received.

In correcting the examination the instructor goes over each answer in detail, makes whatever suggestions or corrections are needed, and, if necessary, writes the student a

Correcting the Examinations

special letter explaining any points that he may have missed, and advising him how he can improve his work. The corrections and criticisms are made very carefully and individually; they cover errors in facts, figures, punctuation, capitalization, and grammar. If the

examination has not been entirely satisfactory, the student is required to work over again the part on which he failed. He is shown just where he made his mistake, and told how to overcome it; but he is not permitted to advance until he has mastered each subject in proper order. In marking the student's work, the School has adopted the system in vogue in most colleges, and uses the grades "Perfect," "Excellent," "Good," or "Fair." These grades correspond to the following percentages: "Perfect," 100%; "Excellent," 90 to 100%; "Good," 80 to 90%; "Fair," 75 to 80%. The percentages obtained by the student in each subject are kept at the School, and the student's average per cent is given to him upon graduation. If the student has sent in a special inquiry on some unusual subject, it is referred to the instructor specializing in that line of work. He looks up the various authorities on the subject so as to get all the information possible, and writes a special letter of explanation; if the matter can be simplified or clarified by diagrams, he prepares a special sketch, which is carefully rendered by one of the many expert draftsmen employed by the School, and enclosed with the letter of explanation.

After having completed his course, and having satisfactorily passed all the examinations, the student is awarded a Diploma or Certificate of Proficiency certifying to these facts. This document

Postgraduate Scholarship constitutes a guarantee of proficiency which is recognized by employers as an indisputable proof that the bearer is a man who has done his best to improve his condition, who is not afraid to work, and who is determined to advance in his chosen line. The School exacts no graduation or Diploma fee. With his Diploma the graduate receives a Postgraduate Scholarship, which entitles him, for five years, to the following benefits: Free instruction (including free textbooks) on any subjects regularly offered by the School, providing he will study systematically. Free consulting service on any subjects regularly taught by the School. Free employment service through the School's Employment Bureau. Liberal discounts on technical books and supplies. This Postgraduate Scholarship is designed to enable the graduate to continue his education, as he finds it necessary to meet the changing demands of his position or profession. The American School never ceases its effort to make its students and graduates efficient.

Name Pearson, Edward B. Occupation Machinist Age 22
 Street _____ Cert. No. 8.57203 Date 2/8/11
 City & State Fredericktown, O. Tuition \$20.00 PAID Ledger No. 207293
 Bus. Ad. Gage & Co. Enrolled by Technical World
 Student Fob _____

Student	Follow Up	Letters
1.	3/20/11	
2.	8/12/11	2/20/11 10/17/11
3.	12/1/11	3/5/11 12/2/11
4.	6/29/12	4/9/11 3/5/12
		4/20/11 7/22/12
		4/28/11 3/1/13

Average% _____ Diploma Awarded _____

Face of Student Record Card

ELECTRICAL ENGINEERING															
SUBJECT				SUBJECT				SUBJECT				SUBJECT			
	BOOK SENT	EXAM RETD	%		BOOK SENT	EXAM RETD	%		BOOK SENT	EXAM RETD	%		BOOK SENT	EXAM RETD	%
Praet. Math. I	1911	1911		Elec. Wir.	1911	1912		Alt. Cur. Mach. II	1913	1913		Mach. Draw III			
	2-8	2-18	90		10-21	2-3	94		2-13	3-14	97				
Pract. Math. II	2-8	2-28	95	Elec. Light	12-20	2-26	94	Alt. Cur. Mach. III	2-19	3-19	97	Mach. Design I			
	2-8	3-27	91		1-10	3-18	95	Alt. Cur. Mach. IV	3-1	3-26	96	Mach. Design II			
Pract. Math. III	2-8	3-27	91	Under. Req. I	2-3	4-13	88	Alt. Cur. Mach. V	3-14	4-5	95	Steam Eng. I			
Pract. Phy. I	2-18	4-15	93	Under. Req. II	2-26	5-22	80	Alt. Cur. Mach. VI	3-19	4-16	95	Steam Eng. II			
Pract. Phy. II	2-28	5-1	90	Elec. Weld.	2-26	5-22	80	Elec. Meas. II	3-26	4-22	94	Pumps			
	2-27	7-29	90	App. Elec. Chem.				Switchboards				Steam Tur. I			
Mech. Draw. I	3-27	8-30	85	Elec. Ry. I	3-18	7-15	95	Pc. Stations	4-5			Steam Tur. II			
	7-29	9-26	80	Elec. Ry. II	4-13	9-1	92	Pr. Trans.	4-16			Gas & Oil Eng. I			
Mech. Draw. II	3-27	5-10	75	Elec. Ry. III	5-22	10-10	92	Dir. Cur. Dyn. II	4-22			Gas & Oil Eng. II			
Chem. of Comb.	3-27	5-10	75	Elec. Ry. IV	7-15	1-8	80	Dir. Cur. Dyn. III				Self Pro. Ry. Cars			
Elem. of Elec.	4-15	5-25	94	Algebra I	9-1	12-2	97	Types of Boilers							
Elec. Cur.	5-1	6-15	97	Algebra II	10-10	1-7	80	Heat							
Elec. Meas. I	5-10	7-12	85	Plane Geom.	11-8	1-29	100	Boiler Acc. I							
Dir. Cur. Dyn. I	5-25	8-18	95	Trig. I & Log.	12-2	2-6	100	Boiler Acc. II							
Dir. Cur. Motors	6-15	9-14	96	Trig. II	1-7	2-13	75	Mechanism							
Types D. E. M. I	7-12	10-3	94	Graphs.	1-29	2-13	60	Mach. Draw. I							
Mgmt. D. E. M. I	8-18	10-24	97	Elem. of Alt. Cur.				Mach. Draw. II							
Mgmt. D. E. M. II	9-14	12-20	95	Alt. Cur. Mach. I	2-6	3-1	86								
Stor. Batteries	10-3	1-10	92												

Back of Student Record Card

ANSWERS TO FREQUENT QUESTIONS

THE American School employs no agents or representatives. It believes that agents have no place in educational work, and that it is not fair to the student to pay out to the agent who enrolls him, 25% of the amount that he paid for instruction. The School asks no better representatives than the students whom it has helped, and the friends whom it has

No Agents made. It secures nearly one-half its annual enrollment through the influence and recommendation of present students or graduates, and of well known men—employers, pastors, educators, lawyers, engineers, and business men—who are glad to recommend the School, and to forward its work.

If the inquirer states what position he is working for, the School can tell him what course will fit him for that position; but it is evident that it requires a considerable knowledge of a man's education, natural ability, habits, likings, etc., to say offhand that a certain course is just the one for him. If the inquirer cannot

What Course decide just what course will be best for him, he should take the one which seems most nearly to meet his present needs. The preliminary work is much the same, and if he wishes to change later it will be his privilege to do so. He will be given credit toward the new course for all work that is identical, and a discount for what he has paid for the work that is duplicated. Every trade or profession offers many good positions to the man who is qualified for them by liking and training. It is, however, a very serious mistake for a man to take up a branch of work for which he has no real liking, just because it seems to offer greater opportunities. A man can do his best at the work that he likes best.

It is false reasoning for a young man to delay enrolling, with the idea that he ought to work a while at his trade before he tries to study it. If he waits until he gets a job, it will take him just so much longer to get started, and he will have less time to study than he has now.

Practical Experience If, on the other hand, he makes the start now, he will be through with the preliminary studies, and ready to get at the subjects that concern his daily work. He will find it much easier to get a position if he already knows something about the

work expected of him. Every employer expects to have to teach his new men his ways, but he expects them to understand general principles. And a young man can get much more valuable experience out of practical work if he knows in advance what he is going to do, than if he first does it and then tries to find out why.

The courses of the American School are planned to take the student over a certain number of subjects; he pays for the work covered, not for the time he requires to complete it. He binds himself to no definite number of hours of study, though the School asks him to endeavor to average ten hours a week, and never to fall below three hours a week. Studying ten hours a week, the average student can complete an instruction book in three weeks, or eighteen instruction books in a year. This average, applied to the number of instruction books in any given course, gives the approximate time required for the completion of that course. There is, however, no limit put upon the speed with which the student may advance, provided that he keeps his work up to the standard required by the School.

The American School cannot guarantee positions, nor does it conduct an employment agency; but it does guarantee to fit a man for the position that he wants to hold. Any school can guarantee positions if it makes no stipulation regarding the kind of work to be done or the salary to be paid; but such a guarantee is a method of securing enrollments so questionable that no reputable school would stoop to it. However, the American School neglects no opportunity to serve its students. Large manufacturing companies and business houses are constantly requesting the School to recommend students who are fitted for their particular work, and that recommendation is often the only proof of fitness required. Employers have learned that students of this School are trained for practical work, and that they will not be recommended unless they are known to be capable of filling the position. Such a reputation is far more valuable to the student than a general guarantee of a "situation" that any one could fill.

Time Required

Securing Employment

**DEPARTMENTS OF
INSTRUCTION**



Section of Instruction Department, American School of Correspondence

ARCHITECTURAL DEPARTMENT

(Opened to students in 1903)

The courses offered in this Department are planned to prepare the student to hold well paid positions in either the designing or the construction branches of the building trades, and to fit him eventually for the position of Architect, Contractor and Builder, or Building Superintendent.

Architecture: This complete course is recommended for every man interested or engaged in architectural or building work, who does not already possess a thorough and systematic knowledge of the subject. It is a mistake for any man entering or engaged in the building trades and professions to confine his knowledge to one branch; even if he intends to specialize, he should have a working knowledge of the whole subject, both to guide him in his choice of a special line, and to give him an understanding of the relation of his specialty to the other branches.

The man who is ambitious to be an employer or superintendent cannot hope to direct other men unless he knows what they can do, and how it should be done. This course will give the inexperienced man a thorough training in all branches of building practice, or enable the man with practical experience to systematize his knowledge, and master the branches in which he has had no experience. It will fit the student to be a Designing, Consulting, or Supervising Architect, Building Superintendent, or General Contractor and Builder.

In California, Colorado, Illinois, Louisiana, New Jersey, and Texas, a state law requires that every plan submitted to the building department for a license to build shall bear the stamp of a licensed Architect; other States are expected soon to enact similar laws. Any man is permitted to plan a building which he will himself erect; but the plans must be approved by an Architect who has satisfied the State of his knowledge of building laws, underwriters' requirements, use of building materials, sound construction etc. The architectural student is advised to inves-

ARCHITECTURE

Prepares for position as Architect, Building Superintendent,
or General Contractor and Builder

72 TEXTBOOKS

NOTE: For detailed description of this course, see page 43. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject
Practical Mathematics Part I
Practical Mathematics Part II
Practical Mathematics Part III
Practical Mathematics Part IV
Practical Physics Part I
Practical Physics Part II
Mechanical Drawing Part I
Mechanical Drawing Part II
Mechanical Drawing Part III
Freehand Drawing
Architectural Lettering
Shades and Shadows
Perspective Drawing
Architectural Drawing Part I
Architectural Drawing Part II
Rendering in Pen and Ink
Study of the Orders Part I
Study of the Orders Part II
Study of the Orders Part III
*Hamlin: History of Architecture
Carpentry Part I
Carpentry Part II
Carpentry Part III
Carpentry Part IV
Steel Square
Stair-Building
Plastering
Painting
Hardware
Algebra Part I
Algebra Part II
Plane Geometry
Logarithmic Tables
Trigonometry
†Graphs
Strength of Materials Part I
Strength of Materials Part II
Statics
Masonry and Reinforced Concrete Part I

Subject
Masonry and Reinforced Concrete Part II
Masonry and Reinforced Concrete Part III
Masonry and Reinforced Concrete Part IV
Masonry and Reinforced Concrete Part V
Steel Construction Part I
Steel Construction Part II
Steel Construction Part III
Steel Construction Part IV
Steel Construction Part V
Roof Trusses
Structural Drafting Part I
Structural Drafting Part II
Heating and Ventilation Part I
Heating and Ventilation Part II
Heating and Ventilation Part III
Plumbing Part I
Plumbing Part II
Plumbing Part III
Sheet-Metal Work Part III
Sheet-Metal Work Part IV
Underwriters' Requirements Part I
Underwriters' Requirements Part II
Building Code
Estimating Part I
Estimating Part II
Estimating Part III (Steel)
Contracts and Specifications Part I
Contracts and Specifications Part II
Legal Relations
Building Superintendence Part I (Frame)
Building Superintendence Part II (Brick and Stone)
Building Superintendence Part III (Steel)
Building Superintendence Part IV (Concrete)

*Standard textbook

†Optional work

Textbooks and Tuition \$155.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

tigate the requirements of his State, if it is included in the list above. A letter of inquiry addressed to the "Board of Examiners for Architect's License", at the State Capital, will bring full information. This course in Architecture will prepare the student to pass the required examinations in any State.

Contracting and Building: This course is recommended for the sub-contracting Mason or Carpenter who wishes to handle the whole contract; for the Mason or Carpenter who wishes to work himself up as a Builder; and for the ambitious Foreman in any of the trades covered who wishes to handle larger jobs. It prepares the student for directing the office and construction work of a general contracting company, or for a position as Building Superintendent in all branches of frame and concrete work.

ARCHITECTURE

(Prepares for position as Architect, Building Superintendent,
or General Contractor and Builder)

SUBJECTS FOR STUDY

(See outline, page 42)

The subjects covered by the course in Architecture fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 42. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to architectural subjects. A review of the elements of physics, as used in determining strains and stresses.

Drawing and Design: Practice in drawing and lettering, with particular attention to the production of working drawings of architectural and structural subjects. Special exercises in the branches of drawing and rendering required for the production of plans and elevations, and exhibition drawings. An analytical study of the history and development of the classical orders of architecture upon which modern architectural design is based.

Carpentry: All branches of carpentry work, including framing, joining, and finishing. Special attention to practical stair-building problems of all kinds. The steel square as a timesaver.

Interior Finishing: A working knowledge of plastering and painting, as required by the general builder. Selection and fitting of interior hardware.

Mathematics: The acquisition, through practical problems, of a working knowledge of algebra as used in "short cut" formulas and rapid estimating. Simplifying building problems by applying the principles of geometry and trigonometry.

Masonry and Concrete: Use of natural and artificial stone for foundations and walls. Reinforced concrete as a building material; with special attention to its use in fire prevention, and a study of up-to-date methods of mixing, reinforcing, and finishing.

Steel Construction: Use of steel frames and details for buildings of all kinds, with particular attention to construction of the "sky-scraper" type. Details involved in use of steel columns, girders, and roof trusses. Calculating strains and stresses to make buildings safe.

Fittings and Fixtures: Planning and installing modern systems of heating, ventilating, and plumbing in buildings of various types. Installing electric wiring and lighting systems in accordance with the fire underwriters' requirements.

Estimating: Estimating material and labor for all branches of building work, on a basis that omits no details, and insures a reasonable profit.

Specification Writing: Collecting and classifying specification details regarding material and labor, and presenting them clearly. General contract forms; peculiarities of government contracts.

Superintendence: Explanation of the rights and duties, under a building contract, of the Owner, Architect, and Contractor. Separate consideration of frame, brick and stone, steel, and concrete construction, so that the Building Superintendent knows, under all conditions, just where to look for careless or dishonest work. Superintending the erection of a steel structure, and of reinforced concrete construction used above and below ground.

CONTRACTING AND BUILDING

Prepares for position as Contractor and Builder, or Building Superintendent

54 TEXTBOOKS

NOTE: For detailed description of this course, see page 46. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject
Practical Mathematics Part I
Practical Mathematics Part II
Practical Mathematics Part III
Practical Mathematics Part IV
Practical Physics Part I
Practical Physics Part II
Plane Geometry
Mechanical Drawing Part I
Mechanical Drawing Part II
Mechanical Drawing Part III
Architectural Lettering
Architectural Drawing Part I
Architectural Drawing Part II
Carpentry Part I
Carpentry Part II
Carpentry Part III
Carpentry Part IV
Steel Square
Stair-Building
Plastering
Painting
Hardware
Strength of Materials Part I
Strength of Materials Part II
Statics
Masonry and Reinforced Concrete Part I
Masonry and Reinforced Concrete Part II
*Masonry and Reinforced Concrete Part III

Subject
Masonry and Reinforced Concrete Part IV
*Masonry and Reinforced Concrete Part V
Cost Analysis Engineering Part I
Cost Analysis Engineering Part II
Sheet-Metal Work Part I
Sheet-Metal Work Part II
Sheet-Metal Work Part III
Sheet-Metal Work Part IV
Underwriters' Requirements Part I
Underwriters' Requirements Part II
Heating and Ventilation Part I
Heating and Ventilation Part II
Heating and Ventilation Part III
Plumbing Part I
Plumbing Part II
Plumbing Part III
Building Code
Estimating Part I
Estimating Part II
Contracts and Specifications Part I
Contracts and Specifications Part II
Legal Relations
Building Superintendence Part I (Frame)
Building Superintendence Part II (Brick and Stone)
Building Superintendence Part III (Steel)
Building Superintendence Part IV (Concrete)

*Optional work

Textbooks and Tuition \$110.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

CONTRACTING AND BUILDING

(Prepares for position as Contractor and Builder, or Building Superintendent)

SUBJECTS FOR STUDY

(See outline, page 45)

The subjects covered by the course in Contracting and Building fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 45. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to building construction. A review of the elements of physics, as used in determining strains and stresses. Simplifying building problems by applying the principles of geometry.

Drawing: Practice in drawing and lettering, with particular attention to the production of working drawings of buildings and details of construction.

Carpentry: All branches of carpentry work, including framing, joining, and finishing. Special attention to practical stair-building problems of all kinds. The steel square as a timesaver.

Interior Finishing: A working knowledge of plastering and painting, as required by the general builder. Selection and fitting of interior hardware.

Masonry and Concrete: Use of natural and artificial stone for foundations and walls. Reinforced concrete as a building material; with special attention to its use in fire prevention, and a study of up-to-date methods of mixing, reinforcing, and finishing.

Fittings and Fixtures: Planning and installing modern systems of heating, ventilating, and plumbing in buildings of various types. Installing electric wiring and lighting systems in accordance with the fire underwriters' requirements.

Estimating: Estimating material and labor for all branches of building work, on a basis that omits no details, and insures a reasonable profit.

Specification Writing: Collecting and classifying specification details regarding material and labor, and presenting them clearly. General contract forms; peculiarities of government contracts.

Superintendence: Explanation of the rights and duties, under a building contract, of the Owner, Architect, and Contractor. Separate consideration of frame, brick and stone, steel, and concrete construction, so that the Building Superintendent knows, under all conditions, just where to look for careless or dishonest work. Approved methods of superintending the erection of a steel structure, and of reinforced concrete construction used above and below ground.

CIVIL ENGINEERING

Prepares for position as general Civil Engineer, or as specialist in Structural, Railroad, Municipal, or Reclamation Engineering

68 TEXTBOOKS

NOTE: For detailed description of this course, see page 50. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject
 Practical Mathematics Part I
 Practical Mathematics Part II
 Practical Mathematics Part III
 Practical Mathematics Part IV
 Practical Physics Part I
 Practical Physics Part II
 Mechanical Drawing Part I
 Mechanical Drawing Part II
 Mechanical Drawing Part III
 *Freehand Drawing
 Perspective Drawing
 Algebra Part I
 Algebra Part II
 Plane Geometry
 Logarithmic Tables
 Trigonometry
 *Graphs
 Plane Surveying Part I
 Plane Surveying Part II
 Plane Surveying Part III
 Plotting and Topography
 Railroad Engineering Part I
 Railroad Engineering Part II
 Railroad Engineering Part III
 Trigonometric Tables
 Earthwork Part I
 Earthwork Part II
 Hydraulics
 Bacteriology and Sanitation
 River and Harbor Improvement
 Sewers and Drains Part I
 Sewers and Drains Part II
 Water Supply Part I
 Water Supply Part II
 Water Supply Part III
 Irrigation Engineering
 Water Power Development Part I
 Water Power Development Part II
 Water Power Development Part III

Subject
 Dams and Weirs Part I
 Dams and Weirs Part II
 Plumbing Part I
 Plumbing Part II
 Plumbing Part III
 Strength of Materials Part I
 Strength of Materials Part II
 Statics
 Masonry and Reinforced Concrete Part I
 Masonry and Reinforced Concrete Part II
 Masonry and Reinforced Concrete Part III
 Masonry and Reinforced Concrete Part IV
 Masonry and Reinforced Concrete Part V
 Highway Construction Part I
 Highway Construction Part II
 Steel Construction Part I
 Steel Construction Part II
 Steel Construction Part III
 Steel Construction Part IV
 Steel Construction Part V
 Roof Trusses
 Structural Drafting Part I
 Structural Drafting Part II
 Bridge Engineering Part I
 Bridge Engineering Part II
 Cost Analysis Engineering Part I
 Cost Analysis Engineering Part II
 Civil Engineering Specifications and Contracts Part I
 Civil Engineering Specifications and Contracts Part II

*Optional work

Textbooks and Tuition \$140.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

CIVIL ENGINEERING DEPARTMENT

(Opened to students in 1903)

The courses offered in this Department are planned to prepare the student to hold well paid positions in either the designing or the construction branches of the civil engineering professions, and to fit him eventually for the position of general Civil Engineer, or for the specialized work of a Structural, Railroad, Municipal, or Reclamation Engineer.

Civil Engineering: This complete course is recommended for every man interested or engaged in civil engineering, who does not already possess a thorough and systematic knowledge of the subject. Civil engineering work is becoming more specialized every day, and most men prefer to confine their efforts to one of the big special lines; but the specialist will do his own work much better if he understands the work of the other specialists with whom he must co-operate. It is comparatively easy for a young man to join a field surveying gang and work up to a position as Instrument Man; but to have his own gang, to handle the great engineering problems of city and State and Nation—to be, in short, a competent Civil Engineer—a man must have, in addition to practical experience, a thorough training in mathematics, strength of materials, mechanics, hydraulics, sanitation, and reinforced concrete.

Such knowledge can be obtained by careful, systematic study much more quickly and surely than by the undirected experience gained in the field or office. Experience is of value only when the man knows the cause as well as the effect. This course will give the inexperienced man a thorough training in all branches of civil engineering, so that he can make a wise choice when he comes to specialize; it will enable the man already at work to systematize his knowledge, and master the branches in which he has had no experience. It will prepare the student for the general work of the Consulting or Directing Civil Engineer, or for the specialized designing, directing, or consulting work of the Structural, Railroad, Municipal, or Reclamation Engineer.

Structural Engineering: This course is recommended for Contractors, Structural Steel and Bridge Workers, Structural Draftsmen, and others who wish a thorough knowledge of structural work. It covers the special branches of building and design that are concerned with heavy construction work involving the use of reinforced concrete and steel, as in "skyscrapers", bridges, etc. It prepares the student for a position as Designing or Supervising Structural Engineer.

CIVIL ENGINEERING

(Prepares for position as general Civil Engineer, or as specialist in Structural, Railroad, Municipal, or Reclamation Engineering)

SUBJECTS FOR STUDY

(See outline, page 48)

The subjects covered by the course in Civil Engineering fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 48. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to civil engineering subjects. A review of the elements of physics, as used in determining forces, moments, strains, and stresses.

Drawing: Practice in drawing and lettering, with particular attention to the production of working drawings of mechanical and structural subjects. Special exercises in freehand and perspective drawing as adapted to the Engineer's need to be able to make rough topographical sketches, or to jot down ideas for special machinery.

Mathematics: The acquisition, through practical problems, of a working knowledge of algebra as used in "short-cut" formulas and rapid estimating. Simplifying engineering problems by applying the principles of geometry and trigonometry.

Surveying: The use of all types of surveying instruments.

Approved surveying practice for city and country, and for public land surveys. Topographical surveying and plotting under all conditions, with special attention to the reduction of field notes, and map making.

Railroad Engineering: Preliminary surveys, and location of the right of way. Approved methods of laying out and constructing tracks, freight yards, and signal systems. Operation and maintenance; including determination of maximum train loads, and safe operating speeds, for all conditions.

Earthwork: Covers standard types of dry land and floating dredges, power excavators, templet excavators, and the methods of applying these machines to the various classes of work. Also includes cost data and comprehensive tabular matter compiled from recent jobs.

Sanitation: An elementary study of bacteriology, as it affects problems connected with water supply and sewage disposal. Up-to-date practice for obtaining, protecting, and distributing municipal water supply, and for collecting and disposing of municipal waste through proper sewerage systems.

Water Power: Practical methods of measuring the volume, pressure, and velocity of liquids under various conditions. Problems of irrigation and drainage. Control and utilization of water power developed naturally or by reclamation projects, with a special consideration of the use and construction of impounding dams and weirs.

Plumbing: The selection, installation, and operation of private sewerage systems, for city or country use.

Masonry and Concrete: Use of natural and artificial stone in engineering projects. Reinforced concrete as a building material; with special attention to its use in abutments, retaining walls, etc., and a study of up-to-date methods of mixing, reinforcing, and finishing.

Highway Construction: The improvement of country roads and city streets; with special attention to the possibility of utilizing local surfacing materials.

Steel Construction: Design and use of steel frames and details

STRUCTURAL ENGINEERING

Prepares for position as Designing or Supervising Structural Engineer

45 TEXTBOOKS

NOTE: For detailed description of this course, see page 53. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject
Practical Mathematics Part I
Practical Mathematics Part II
Practical Mathematics Part III
Practical Mathematics Part IV
Practical Physics Part I
Practical Physics Part II
Mechanical Drawing Part I
Mechanical Drawing Part II
Mechanical Drawing Part III
Freehand Drawing
Perspective Drawing
Algebra Part I
Algebra Part II
Plane Geometry
Logarithmic Tables
Trigonometry
*Graphs
Plane Surveying Part I
Plane Surveying Part II
Strength of Materials Part I
Strength of Materials Part II
Statics
Masonry and Reinforced Concrete Part I
Masonry and Reinforced Concrete Part II
Masonry and Reinforced Concrete Part III

Subject
Masonry and Reinforced Concrete Part IV
Masonry and Reinforced Concrete Part V
Building Superintendence Part IV (Concrete)
Steel Construction Part I
Steel Construction Part II
Steel Construction Part III
Steel Construction Part IV
Steel Construction Part V
Estimating Part III (Steel)
Building Superintendence Part III (Steel)
Roof Trusses
Structural Drafting Part I
Structural Drafting Part II
Bridge Engineering Part I
Bridge Engineering Part II
Cost Analysis Engineering Part I
Cost Analysis Engineering Part II
Building Code
Civil Engineering Specifications and Contracts Part I
Civil Engineering Specifications and Contracts Part II

*Optional work

Textbooks and Tuition \$95.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

for buildings, bridges, viaducts, etc. Details involved in use of steel columns, girders, and roof trusses. Solving strains and stresses to make steel structures safe.

Bridge Engineering: Design and construction of steel bridges and bridge work for all purposes; with special attention to the development of trusses and the determination of the span.

Specifications and Contracts: Collecting and classifying specification details regarding material and labor, and presenting them clearly. Figuring costs on a basis that omits nothing and insures a reasonable profit. Contracts that bind and protect.

STRUCTURAL ENGINEERING

(Prepares for position as Designing or Supervising Structural Engineer)

SUBJECTS FOR STUDY

(See outline, page 52)

The subjects covered by the course in Structural Engineering fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 52. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to structural subjects. A review of the elements of physics, as used in determining forces, moments, strains, and stresses.

Drawing: Practice in drawing and lettering, with particular attention to the production of working drawings of structural subjects. Special exercises in freehand and perspective drawing, as adapted to the Structural Engineer's need to be able to make rough sketches, or to jot down ideas for special construction forms.

Mathematics: The acquisition, through practical problems, of a working knowledge of algebra as used in "short-cut" formulas and rapid estimating. Simplifying structural problems by applying the principles of geometry and trigonometry.

Surveying: The use of all types of surveying instruments used in structural work. Methods of keeping notes and arranging data.

Masonry and Concrete: Use of natural and artificial stone for foundations and walls. Reinforced concrete as a building material; with special attention to its use in fire prevention, and a study of up-to-date methods of mixing, reinforcing, and finishing.

Steel Construction: Design and use of steel frames and details for buildings of all kinds, with particular attention to construction of the "sky-scraper" type. Details involved in use of steel columns, girders, and roof trusses. Calculating strains and stresses to make buildings safe.

Bridge Engineering: Design and construction of steel bridges and bridge work for all purposes; with special attention to the development of trusses and the determination of the span.

Specifications and Contracts: Collecting and classifying specification details regarding material and labor, and presenting them clearly. Figuring costs on a basis that omits nothing and insures a reasonable profit. Contracts that bind and protect.

ELECTRICAL ENGINEERING DEPARTMENT

(Opened to students in 1897)

The courses offered in this Department are planned to prepare the student to hold well paid positions in either the designing, construction, operating, or consulting branches of the electrical engineering profession, and to fit him eventually for the position of Designing, Erecting, or Operating Electrical or Telephone Engineer. The work of the Telephone Engineer is so distinct and so important that it constitutes a profession in itself.

Electrical Engineering: This complete course is recommended for every man engaged or interested in general electrical work who does not already possess a systematic knowledge of the branches that it covers. Electricity is now applied to so many widely different uses that the electrical worker must specialize to a considerable extent; but before he chooses his particular line, he should have the general training upon which specialization must be based.

Electrical progress is so rapid that the man who keeps up with it must have a general fundamental knowledge of what has been done, in order to give the requisite amount of time and thought to new discoveries and inventions. Within the last ten years the demand for electrical workers has attracted thousands of men who were not "making good" in other lines; and their failure to better themselves has led to the belief that the electrical field is overcrowded. It is overcrowded with men whose electrical knowledge will hardly enable them to run a wire according to underwriters' requirements; but it offers splendid opportunities for men who are qualified to hold responsible positions, or do high grade, intelligent work.

This course will give the inexperienced man a thorough training in general electrical work; or enable the man of experience to systematize his knowledge, and master the branches in which he has had no experience. It is planned particularly to meet the requirements of the electrical worker employed in a power plant which uses steam or gas power as a prime mover. It will prepare

the student for a position as Electrical Engineer or Designer, in connection with a power or light plant, a manufacturing concern, general consulting work, or as Chief Engineer in charge of a power plant.

Electro-Mechanical Engineering: This complete course is recommended for all men engaged or interested in the design or manufacture of electrical appliances and apparatus. A large part of the men today working in the mechanical trades and professions are concerned wholly or in part with problems arising from the improvement or invention of machines utilizing electrical power. This course is planned to instruct the student how to apply mechanical principles to these growing electrical problems. It prepares him for a position as Designing or Consulting Electro-Mechanical Engineer, or as Superintendent of a factory manufacturing electrical appliances.

Hydroelectric Engineering: This complete course is recommended for every man engaged or interested in the generation of electricity by water power. It covers the same general work as Electrical Engineering, but gives particular attention to the development of water power, the design of water turbines, and the construction and operation of hydraulic power plants. It is especially deserving of careful consideration at this time, when the utilization of water power is becoming so important a factor in all branches of industry. It prepares for a position as Hydroelectric Engineer or Designer in connection with a hydroelectric power or light plant, or general consulting work.

Telephone Practice: This complete course is recommended for every man engaged or interested in telephone work, who does not already possess a thorough and systematic knowledge of the subjects that it covers. Telephony, while a branch of electrical engineering, is a distinct profession, and should be so studied. It involves many problems in mechanics, acoustics, and electricity peculiar to itself. The continual improvements in apparatus and practice, the application of the telephone to new uses, and the inevitable perfection of wireless systems, require the most thorough training of the man who would keep up with the advance of the profession.

This course is based upon the most improved methods of telephone practice; it gives thorough instruction in the construction and maintenance of standard telephone systems, and can be studied to advantage by Linemen, "Troubleshooters", Wire Chiefs, Managers, Railway Dispatchers, Electricians, and all who want a more thorough knowledge of telephone practice. It prepares for a position as Designer, or Operating or Consulting Telephone Engineer.

ELECTRICAL ENGINEERING

(Prepares for position as Electrical Engineer or Designer in Power Plant, Manufacturing Concern, or Construction Work)

SUBJECTS FOR STUDY

(See outline, page 58)

The subjects covered by the course in Electrical Engineering fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 58. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to electrical engineering subjects. A review of the elements of physics, as used in determining strains and stresses. Elementary chemistry, necessary to an understanding of steam boilers.

Drawing: Practice in mechanical drawing and lettering, with particular attention to the production of working drawings of electrical machinery and appliances.

Electrical Principles: Basic theories of the nature of electricity; terms used in electrical work; laws of energy, resistance, etc.

Dynamos and Motors: Principles of construction and operation of machines for generating and applying electrical energy. Discussion of different types to meet different conditions and needs. Explanation of difference in principle and application of direct- and alternating-current machinery.

Management: Selection, installation, and operation of dynamo-

ELECTRICAL ENGINEERING

Prepares for position as Electrical Engineer or Designer in Power Plant, Manufacturing Concern, or Consulting Work

70 TEXTBOOKS

NOTE: For detailed description of this course, see page 57. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject

Practical Mathematics Part I
 Practical Mathematics Part II
 Practical Mathematics Part III
 Practical Mathematics Part IV
 Practical Physics Part I
 Practical Physics Part II
 Mechanical Drawing Part I
 Mechanical Drawing Part II
 Mechanical Drawing Part III
 Chemistry of Combustion
 Elements of Electricity Part I
 Elements of Electricity Part II
 Elements of Electricity Part III
 Direct-Current Dynamos Part I (Principles)
 Direct-Current Motors
 Types of Generators and Motors Part I (Direct Current)
 Management of Dynamo Electric Machinery Part I
 Management of Dynamo Electric Machinery Part II
 Storage Batteries
 Electric Wiring
 Electric Lighting
 Underwriters' Requirements Part I
 Underwriters' Requirements Part II
 Welding
 Applied Electrochemistry
 Electric Railways Part I
 Electric Railways Part II
 Electric Railways Part III
 Electric Railways Part IV
 Elevators Part III (Electric)
 Algebra Part I
 Algebra Part II
 Plane Geometry
 Logarithmic Tables
 Trigonometry
 *Graphs
 Elements of Alternating Current

Subject

Alternating Current Machinery Part I (Fundamental Principles)
 Alternating Current Machinery Part II (Alternators)
 Alternating Current Machinery Part III (Testing—Synchronous Motors)
 Alternating Current Machinery Part IV (Transformers)
 Alternating Current Machinery Part V (Converters)
 Alternating Current Machinery Part VI (Induction Motors—Switchboards)
 Types of Generators and Motors Part II (Alternating Current)
 Electrical Measurements Part I (Instruments and Methods)
 Electrical Measurements Part II (Watt-Hour Meters)
 Switchboards
 Power Stations
 Power Transmission
 Direct-Current Dynamos Part II (Calculations)
 Direct-Current Dynamos Part III (Design)
 Types of Boilers
 Heat
 Boiler Accessories
 Boiler Practice
 Mechanism
 Machine Drawing Part I
 Machine Drawing Part II
 Machine Drawing Part III B
 Machine Design Part I
 Machine Design Part II
 Steam Engines Part I
 Steam Engines Part II
 Pumps
 Steam Turbines Part I
 Steam Turbines Part II
 Gas and Oil Engines Part I
 Gas and Oil Engines Part II
 Gas and Oil Engines Part III
 Self-Propelled Railway Cars

*Optional work

Textbooks and Tuition \$145.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

electric machinery for all purposes. Approved methods of inspecting and testing, with particular attention to preventing, localizing, and remedying dynamo "trouble." The practical use of storage batteries in power and light plants.

Wiring and Lighting: Planning convenient electric wiring and lighting systems, and installing them in accordance with the fire underwriters' requirements.

Special Appliances: Special commercial uses of the electric current, as in welding, cutting steel beams, brazing, electroplating, and electric furnace work. Electric elevators for freight and passenger service.

Electric Railways: Details of construction and operation of all standard types of cars for city and interurban electric railways. Construction and operation of power plants and substations for electric railway lines using either direct or alternating current, with particular attention to the construction and protection of transmission lines. The electrification of steam railways.

Mathematics: The acquisition, through practical problems, of a working knowledge of algebra as used in "short-cut" formulas and rapid estimating. Simplifying electrical problems by applying the principles of geometry and trigonometry.

Alternating-Current Machinery: Explanation of elementary principles of alternating current, and glossary of terms used. Commercial application of alternating current to various uses, including a discussion of methods of constructing, testing, and operating alternating-current machinery suitable for various local conditions.

Measurements: Explanation of methods and instruments used in measuring electrical resistance of lines, batteries, etc.; with special attention to the use of watt-hour meters.

Central Stations: Location and construction of power stations using either steam or water as a prime mover. Construction, installation, and operation of switchboards and protective apparatus. Planning and installing distribution systems of various types, and reducing wire resistance.

Direct-Current Dynamos: A special consideration of the

design and construction of dynamos for plants using direct current, planned to assist in the selection of the proper machinery.

Steam Principles: Elementary discussion of the theory and application of heat energy, and the types of boilers best adapted to conditions affecting central station plants.

Boilers: Details of construction, with special attention to labor-saving accessories, such as mechanical stokers. Proper care and operation of boilers of various types.

Machine Design: Principles and methods of designing machinery for electrical and other special purposes, with particular regard to the factor of safety. Careful discussion of the types of gearing, pulleys, gears, etc., most efficient under given conditions.

Steam Engines and Turbines: Selection of engines for particular work; their erection and economical operation, with a complete explanation of testing methods and apparatus. The different types of modern steam turbines; their design and operation, together with a discussion of their advantages and disadvantages for different kinds of work, as compared with reciprocating engines.

Gas and Oil Engines: Principles, design, and operation of this new type of power producers. Explains the use of different fuels, and the types of engines commonly used in power plants.

ELECTRO-MECHANICAL ENGINEERING

(Prepares for position as Electro-Mechanical Engineer, or Superintendent of Factory manufacturing Electrical Appliances)

SUBJECTS FOR STUDY

(See outline, page 61)

The subjects covered by the course in Electro-Mechanical Engineering fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 61. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

ELECTRO-MECHANICAL ENGINEERING

Prepares for position as Electro-Mechanical Engineer, or
Superintendent of Factory manufacturing
Electrical Appliances

65 TEXTBOOKS

NOTE: For detailed description of this course, see page 60. For
synopses of textbooks, see alphabetical list of subjects, page 153.

Subject	Subject
Practical Mathematics Part I	Construction of Boilers
Practical Mathematics Part II	Types of Boilers
Practical Mathematics Part III	Heat
Practical Mathematics Part IV	Boiler Accessories
Practical Physics Part I	Boiler Practice
Practical Physics Part II	Mechanism
Mechanical Drawing Part I	Machine Drawing Part I
Mechanical Drawing Part II	Machine Drawing Part II
Mechanical Drawing Part III	Machine Drawing Part III B
Chemistry of Combustion	Machine Design Part I
Elements of Electricity Part I	Machine Design Part II
Elements of Electricity Part II	Steam Engines Part I
Elements of Electricity Part III	Steam Engines Part II
Direct-Current Dynamos Part I	Pumps
(Principles)	Steam Turbines Part I
Direct-Current Motors	Steam Turbines Part II
Types of Generators and Motors Part I	Steam Engine Indicators
(Direct Current)	Valve Gears
Storage Batteries	Gas and Oil Engines Part I
Electric Wiring	Gas and Oil Engines Part II
Electric Lighting	Gas and Oil Engines Part III
Underwriters' Requirements Part I	Gas-Producers
Underwriters' Requirements Part II	Pattern Making Part I
Elevators Part III (Electric)	Pattern Making Part II
Algebra Part I	Foundry Work Part I
Algebra Part II	Foundry Work Part II
Plane Geometry	Forging
Logarithmic Tables	Welding
Trigonometry	Applied Electrochemistry
Elements of Alternating Current	Machine-Shop Work Part I
Types of Generators and Motors Part	Machine-Shop Work Part II
II (Alternating Current)	Machine-Shop Work Part III
Management of Dynamo Electric	Machine-Shop Work Part IV
Machinery Part I	Machine-Shop Work Part V
Management of Dynamo Electric	
Machinery Part II	

Textbooks and Tuition \$135.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

Elementary: A review of simple mathematical principles, as applied to electro-mechanical subjects. A review of the elements of physics, as used in determining strains and stresses. Elementary chemistry, necessary to an understanding of steam boilers.

Drawing: Practice in mechanical drawing and lettering, with particular attention to the production of working drawings of electro-mechanical appliances.

Electrical Principles: Basic theories of the nature of electricity; terms used in electrical work; laws of energy, resistance, etc.

Dynamos and Motors: Principles of construction and operation of machines for generating and applying electrical energy. Discussion of different types to meet different conditions and needs. Explanation of difference in principle and application of direct- and alternating-current machinery.

Wiring and Lighting: Planning convenient electric wiring and lighting systems, and installing them in accordance with the fire underwriters' requirements.

Mathematics: The acquisition, through practical problems, of a working knowledge of algebra as used in "short-cut" formulas and rapid estimating. Simplifying electro-mechanical problems by applying the principles of geometry and trigonometry.

Alternating Current: Explanation of elementary principles of alternating current, and glossary of terms used. Types of alternating-current machinery suitable for various local conditions.

Management: Construction, installation, and operation of dynamo-electric machinery for all purposes. Approved methods of inspecting and testing, with particular attention to preventing, localizing, and remedying dynamo "trouble." The practical use of storage batteries in power and light plants

Steam Principles: Elementary discussion of the theory and application of heat energy, and the types of boilers best adapted to conditions affecting central station plants.

Boilers: Details of construction, with special attention to

labor-saving accessories, such as mechanical stokers. Proper care and operation of boilers of various types.

Machine Design: Principles and methods of designing machinery for electrical and other special purposes, with particular regard to the factor of safety. Careful discussion of the types of gearing, pulleys, gears, etc., most efficient under given conditions.

Steam Engines and Turbines: Selection of engines for particular work; their erection and economical operation, with a complete explanation of testing methods and apparatus. The different types of modern steam turbines; their design and operation, together with a discussion of their advantages and disadvantages for different kinds of work, as compared with reciprocating engines.

Engine Accessories: Different types of indicators, how to take cards, and how to use the results obtained in determining efficiency and trouble. Construction of valves, and the common types of gears used to operate them, with a description of special gears; the proper adjustment of gears for economy and efficiency with any given load and speed.

Gas and Oil Engines: Principles, design, and operation of this new type of power producers. Explains the use of different fuels, and discusses the types of engines best adapted to different purposes.

Pattern Making: Use of materials and tools. Methods of making and finishing patterns for various machine parts.

Foundry Work and Forging: Selection and testing of different kinds of molding sand; making molds and cores of various kinds; approved methods of melting and pouring metals. Materials and methods employed in forging, with special attention to the advantages and disadvantages of standard methods of welding.

Special Appliances: Special commercial uses of the electric current, as in welding, cutting steel beams, brazing, electroplating, and electric furnace work. Electric elevators for freight and passenger service.

Machine-Shop Work: Use of standard tools, with a special

HYDROELECTRIC ENGINEERING

Prepares for position as Hydroelectric Engineer or Designer
in Power Plant or Consulting Work

65 TEXTBOOKS

NOTE: For detailed description of this course, see page 65. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject
Practical Mathematics Part I
Practical Mathematics Part II
Practical Mathematics Part III
Practical Mathematics Part IV
Practical Physics Part I
Practical Physics Part II
Mechanical Drawing Part I
Mechanical Drawing Part II
Mechanical Drawing Part III
Chemistry of Combustion
Elements of Electricity Part I
Elements of Electricity Part II
Elements of Electricity Part III
Direct-Current Dynamos Part I (Principles)
Direct-Current Motors
Types of Generators and Motors Part I (Direct Current)
Management of Dynamo Electric Machinery Part I
Management of Dynamo Electric Machinery Part II
Storage Batteries
Electric Wiring
Electric Lighting
Underwriters' Requirements Part I
Underwriters' Requirements Part II
Welding
Applied Electrochemistry
Electric Railways Part I
Electric Railways Part II
Electric Railways Part III
Electric Railways Part IV
Algebra Part I
Algebra Part II
Plane Geometry
Logarithmic Tables
Trigonometry

Subject
Elements of Alternating Current
Alternating Current Machinery Part I (Fundamental Principles)
Alternating Current Machinery Part II (Alternators)
Alternating Current Machinery Part III (Testing—Synchronous Motors)
Alternating Current Machinery Part IV (Transformers)
Alternating Current Machinery Part V (Converters)
Alternating Current Machinery Part VI (Induction Motors—Switchboards)
Types of Generators and Motors Part II (Alternating Current)
Electrical Measurements Part I (Instruments and Methods)
Electrical Measurements Part II (Watt-Hour Meters)
Switchboards
Power Stations
Power Transmission
Direct-Current Dynamos Part II (Calculations)
Direct-Current Dynamos Part III (Design)
Strength of Materials Part I
Strength of Materials Part II
Statics
Masonry and Reinforced Concrete Part I
Masonry and Reinforced Concrete Part II
Masonry and Reinforced Concrete Part III
Masonry and Reinforced Concrete Part IV
Masonry and Reinforced Concrete Part V
Hydraulics
Dams and Weirs Part I
Dams and Weirs Part II
Water Supply Part I
Water Supply Part II
Water-Power Development Part I
Water-Power Development Part II
Water-Power Development Part III

Textbooks and Tuition \$130.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

discussion of the proper speeds for various kinds of metal. Detailed explanation of construction and operation of standard types of lathes, milling machines, etc., including special features of automatic machines. Approved methods of management for machine shops of various types and sizes; practical systems for shop records, time-keeping, etc.

HYDROELECTRIC ENGINEERING

(Prepares for position of Hydroelectric Engineer or Designer
in power plant or consulting work)

SUBJECTS FOR STUDY

(See outline, page 64)

The subjects covered by the course in Hydroelectric Engineering fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 64. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to hydroelectric engineering subjects. A review of the elements of physics, as used in determining strains and stresses.

Drawing: Practice in mechanical drawing and lettering, with particular attention to the production of working drawings of hydroelectric machinery and appliances.

Electrical Principles: Basic theories of the nature of electricity; terms used in electrical work; laws of energy, resistance, etc.

Dynamos and Motors: Principles of construction and operation of machines for generating and applying electrical energy. Discussion of different types to meet different conditions and needs. Explanation of difference in principle and application of direct- and alternating-current machinery.

Management: Construction, installation, and operation of dynamo-electric machinery for all purposes. Approved methods of inspecting and testing, with particular attention to preventing,

localizing, and remedying dynamo trouble. The practical use of storage batteries in power and light plants.

Wiring and Lighting: Planning convenient electric wiring and lighting systems, and installing them in accordance with the fire underwriters' requirements.

Special Appliances: Special commercial uses of the electric current, as in welding, cutting steel beams, brazing, electroplating, and electric furnace work.

Electric Railways: Details of construction and operation of all standard types of cars for city and interurban electric railways. Construction and operation of hydroelectric power plants and substations for electric railway lines using either direct or alternating current, with particular attention to the construction of transmission lines. The electrification of steam railways.

Mathematics: The acquisition, through practical problems, of a working knowledge of algebra as used in "short-cut" formulas and rapid estimating. Simplifying hydroelectric problems by applying the principles of geometry and trigonometry.

Alternating-Current Machinery: Explanation of elementary principles of alternating current, and glossary of terms used. Commercial application of alternating current to various uses, including a discussion of methods of constructing, testing, and operating alternating-current machinery suitable for various local conditions.

Measurements: Methods and instruments used in measuring electrical resistance of lines, batteries, etc.; with special attention to the use of watt-hour meters.

Central Stations: Location and construction of hydroelectric power stations. Construction, installation, and operation of switchboards and protective apparatus. Planning and installing distribution systems of various types, and reducing wire resistance.

Direct-Current Dynamos: A special consideration of the design and construction of dynamos for plants using direct current, planned to assist in the selection of the proper machinery.

Masonry and Concrete: Use of natural and artificial stone for hydroelectric projects, and in the construction of power plants. Reinforced concrete as a building material; with special attention to its use in dams, abutments, retaining walls, etc., and a study of up-to-date methods of mixing, reinforcing, and finishing.

Water Power: Practical methods of measuring the volume, pressure, and velocity of liquids under various conditions. Control and utilization of water power developed naturally or by reclamation projects, with a special consideration of the use and construction of impounding dams and weirs.

TELEPHONE PRACTICE

(Prepares for position as Operating, Consulting,
or Designing Telephone Engineer)

SUBJECTS FOR STUDY

(See outline, page 68)

The subjects covered by the course in Telephone Practice fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 68. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to telephone engineering subjects. A review of the elements of physics, as used in determining strains and stresses.

Drawing: Practice in mechanical drawing and lettering, with particular attention to the production of working drawings.

Electrical Principles: Basic theories of the nature of electricity; terms used in electrical work; laws of energy, resistance, etc. Explanation of electro-mechanical appliances that reproduce speech.

Substations: Detailed explanation of standard types of transmitters, receivers, and other appliances that make up the equipment of a substation, together with a special study of induction coils, condensers, and similar devices that facilitate service.

TELEPHONE PRACTICE

**Prepares for position as Operating, Consulting, or Designing
Telephone Engineer**

32 TEXTBOOKS

NOTE: For detailed description of this course, see page 67. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject	Subject
Practical Mathematics Part I	Telephony Part VIII (Manual Switchboards)
Practical Mathematics Part II	Telephony Part IX (Automatic Systems)
Practical Mathematics Part II	Telephony Part X (Power Plants and Buildings)
Practical Mathematics Part IV	Telephony Part XI (Special Service Features)
Practical Physics Part I	Telephony Part XII (Telegraph and Railway Work)
Practical Physics Part II	Telephony Part XIII (Line Construction)
Mechanical Drawing Part I	Telephony Part XIV (Line Construction)
Mechanical Drawing Part II	Telephony Part XV (Engineering and Maintenance)
Mechanical Drawing Part III	*Electric Telegraph Part I
Elements of Electricity Part I	*Electric Telegraph Part II
Elements of Electricity Part II	*Modern Land and Submarine Telegraph
Elements of Electricity Part III	*Wireless Telegraphy
Telephony Part I (Fundamental Principles)	*Wireless Telephony
Telephony Part II (Substation Equipment)	
Telephony Part III (Substation Equipment)	
Telephony Part IV (Party-Line Systems)	
Telephony Part V (Protection)	
Telephony Part VI (Manual Switchboards)	
Telephony Part VII (Manual Switchboards)	

*Optional work

Textbooks and Tuition \$70.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

Party-Lines: Principles and practice of non-selective, selective, and lock-out party-line systems, with particular attention to their respective advantages and disadvantages.

Protection: Approved methods of protecting exchanges, instruments, and transmission lines against lightning, fire, and the vagaries of the electric current.

Switchboards: Consideration of all standard types of exchange switchboards, with a discussion of their adaptability to local conditions. Detailed explanation of the principles and use of multiple switchboards; methods of trunking in multi-office systems. Comparison of manual and automatic systems.

Power Plants: Kind of current employed, and methods of obtaining supply. Planning central and branch exchanges for manual and automatic systems of all types and sizes.

Special Service: Specialized branches of telephone practice requiring special appliances, as private-branch exchanges, long-distance calls, and measured service.

Railway Work: Use of the telephone in steam and electric railway train dispatching, with particular attention to systems employing both telegraph and telephone.

Line Construction: Selection of wires, poles, conduits, fittings, etc., for overhead and underground lines. Approved methods of construction; best practice in handling the special problems presented by office buildings, flats, etc. Prevention of and remedy for electrolysis of underground cables.

Maintenance: Methods of increasing territory served, and of perfecting service. Keeping plant and equipment in good working order. Testing and remedying troubles of all sorts.

Telegraphy: Railway and commercial telegraphy, with particular attention to the equipment and organization of large commercial offices. Principles and practice of submarine telegraphy.

Wireless Work: Principles of the standard systems of wireless telegraphy and telephony.

MECHANICAL ENGINEERING

Prepares for position as Consulting or Operating Mechanical Engineer, or Superintendent of Manufacturing Plant

65 TEXTBOOKS

NOTE: For detailed description of this course, see page 74. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject	Subject
Practical Mathematics Part I	Algebra Part I
Practical Mathematics Part II	Algebra Part II
Practical Mathematics Part III	Plane Geometry
Practical Mathematics Part IV	Logarithmic Tables
Practical Physics Part I	Trigonometry
Practical Physics Part II	Machine Design Part I
Chemistry of Combustion	Machine Design Part II
Metallurgy	Steam Engines Part I
Mechanical Drawing Part I	Steam Engines Part II
Mechanical Drawing Part II	Pumps
Mechanical Drawing Part III	Steam Turbines Part I
Pattern Making Part I	Steam Turbines Part II
Pattern Making Part II	Steam Engine Indicators
Foundry Work Part I	Valve Gears
Foundry Work Part II	Compressed Air Part I
Forging	Compressed Air Part II
Welding	Gas and Oil Engines Part I
Machine-Shop Work Part I	Gas and Oil Engines Part II
Machine-Shop Work Part II	Gas and Oil Engines Part III
Machine-Shop Work Part III	Gas-Producers
Machine-Shop Work Part IV	Locomotive Boilers and Engines Part I
Machine-Shop Work Part V	Locomotive Boilers and Engines Part II
Tool Making Part I	Air-Brakes Part I
Tool Making Part II	Air-Brakes Part II
Tool Making Part III	Elevators Part I (Hand and Belt)
Construction of Boilers	Elevators Part II (Steam and Hydraulic)
Types of Boilers	Elevators Part III (Electric)
Heat	Elevators Part IV (Equipment)
Boiler Accessories	Refrigeration Part I
Boiler Practice	Refrigeration Part II
Mechanism	Refrigeration Part III
Machine Drawing Part I	
Machine Drawing Part II	
Machine Drawing Part III A	

Textbooks and Tuition \$135.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

MECHANICAL ENGINEERING DEPARTMENT

(Opened to students in 1897)

The courses offered in this Department are planned to prepare the student to hold well paid positions in either the designing, construction, operating, or consulting branches of the mechanical engineering profession, and to fit him eventually for the position of Operating or Consulting Mechanical, Steam, or Marine Engineer, Factory Superintendent, Stationary or Locomotive Engineer, Shop Foreman, or Chauffeur. Steam Engineering and Automobile Work, although properly branches of Mechanical Engineering, are distinct professions in themselves, and should be studied as such.

Mechanical Engineering: This complete course is recommended for every man engaged or interested in general mechanical work, who does not already possess a systematic knowledge of the branches that it covers. It is a simple matter for the young man with a mechanical bent to get a job as Helper in a machine shop, and work up to be an expert Machine Hand; but if he relies upon experience alone, he will seldom get any higher. Machine shop work is of necessity highly specialized; parts which are duplicated by the thousands are turned out by the piecework system; and the man who can run one machine "with his eyes shut" will waste time and spoil valuable material experimenting to "get the hang" of a strange machine.

Mechanical engineering offers too broad a field for the ambitious man to be content as a Machine Hand. Every progressive industry in the world today depends upon the mechanic for its tools, implements, and machines; and the man who knows most about mechanical principles and practice has first chance at the big opportunities for advancement created by the growing demand for highly trained mechanics. Some of the best mechanical positions are found outside the shop, in connection with the manufacturing department of concerns that employ a few skilled Engineers to superintend the work of hundreds of Machine Hands.

This course will give the inexperienced man a thorough training in general mechanical work; or enable the man of experience to systematize his knowledge, and master the branches in which he has had no experience. It will prepare the student to get the training required for a position as Consulting or Operating Mechanical Engineer, or as Superintendent of a manufacturing plant using steam or gas power.

Steam Engineering: This complete course in the principles and operation of the steam engine, and in the various applications of steam power, is recommended for every man engaged or interested in the use of steam power. It covers the same general ground as Mechanical Engineering, but gives particular attention to the use of steam, including the use of steam in the generation of electricity.

Steam Engineering is divided into Stationary and Locomotive, according as the power developed is applied to operating a factory or a light and power plant, or to transportation. By a grouping of the specialized subjects, the student is enabled to omit those subjects which do not bear directly upon the line of work that he desires to follow. (See outline, page 78.)

Group I. (Stationary Engineering): Specialization in this Group is recommended for every man interested in the construction or operation of stationary or marine steam engines. The student will omit Group II, which covers locomotive engines.

In spite of the growing use of hydraulic and electric power, the steam engine is still an important factor in commerce and the industries, because continual improvement has kept it up to the work demanded of it. The stationary engine, however, is no longer the greatest prime mover; in the largest and most modern plants its energy is transformed into electricity, or compressed air, or some other more flexible operative force. Thus the up-to-date engineer is required not only to understand the complex modern engine, but also to have a working knowledge of the special applications of the power that he generates. Without this knowledge he can never hope to become Superintendent of the plant, but must remain a working engineer. This course

will give the inexperienced man a thorough training in stationary engineering; or enable the man of experience to systematize his knowledge, and master the branches in which he has had no experience.

Every State in the Union requires an Operating Stationary Engineer to have a license, which can be obtained only from the State, by successfully meeting the tests of knowledge and experience that the State may set. This course (Group I) will prepare the student to pass with high grade the Stationary Engineer's license examination in any State; but no school is authorized to issue an engineer's license. A letter of inquiry addressed to the "Board of Examiners for Steam Engineer's License", at the State Capital, will bring the applicant full information regarding the license requirements of his State.

Marine Firemen, Stokers, Oilers, and others interested in marine engineering will find in this Stationary Engineering course all necessary specialized information on the construction and operation of marine boilers and engines. Every Operating Marine Engineer must have a Federal license. A letter of inquiry to the "Board of Examiners for Marine Engineer's License," Federal Building, addressed to the nearest large port, will bring full information regarding license requirements. This course will give the student the knowledge necessary to pass the Federal examination, and will prepare him for a position as Marine Engineer.

Group II. (*Locomotive Engineering*): Specialization in this Group is recommended for Locomotive Firemen, Brakemen, and others interested in railroad work. The student will omit Groups I and III, which respectively cover stationary and marine engines. This course prepares the student for a position as Locomotive Engineer.

Shop Practice: This short course in the use of tools and machines, and forging and general foundry practice, is designed to enable men already engaged in the mechanical trades to increase their chances of promotion by adding practical knowledge to their shop experience. It is recommended for Machinists, Toolmakers, Pattern Makers, Blacksmiths, and Foundry Men. It prepares the student for a position as Shop Foreman.

Automobile Course: This complete course in the construction and operation of standard types of gasoline, electric, and steam automobiles is recommended for every man interested in the operation, repair, equipment, or manufacture of automobiles. Whether used as a pleasure vehicle, or for commercial purposes, the automobile has become an important factor in the modern system of transportation. Its mechanical perfection makes it dependable in the hands of any one who exercises reasonable care, while its adaptability makes it available for many different purposes. It is, however, a delicate mechanical contrivance, which, while not complicated in its operation, involves certain principles of combustion and of mechanism which require study. This course will save time, money, and annoyance for the automobile owner who runs his own car, and give him a mastery of his machine that will add much to his pleasure; while it will enable the professional Chauffeur to operate or repair any standard type of car. It prepares for a position as Chauffeur, Garage Keeper, or Repairman.

MECHANICAL ENGINEERING

(Prepares for position as Consulting or Operating Mechanical Engineer, or Superintendent of manufacturing plant)

SUBJECTS FOR STUDY

(See outline, page 70)

The subjects covered by the course in Mechanical Engineering fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 70. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to mechanical engineering subjects. A review of the elements of physics, as used in determining strains and stresses. Elementary chemistry, necessary to an understanding of steam boilers. Principles of working metals and producing alloys.

Drawing: Practice in mechanical drawing and lettering, with particular attention to projections.

Pattern Making: Use of materials and tools. Methods of making and finishing patterns for various machine parts.

Foundry Work and Forging: Selection and testing of different kinds of molding sand; making molds and cores of various kinds; approved methods of melting and pouring metals. Materials and methods employed in forging, with special attention to the advantages and disadvantages of standard methods of welding, including electric welding.

Machine-Shop Work: Use of standard tools, with a special discussion of the proper speeds for various kinds of metal. Detailed explanation of construction and operation of standard types of lathes, milling machines, etc., including special features of automatic machines. Approved methods of management for machine shops of various types and sizes; practical systems for shop records, time-keeping, etc.

Tool Making: Selection and tempering of steel for tools for different purposes. Designing and making machine tools of all types, and for all standard machines. Making punches and dies, and gages for measuring various angles and dimensions.

Steam Principles: Elementary discussion of the theory and application of heat energy, and the types of boilers best adapted to conditions affecting different plants.

Boilers: Details of construction, with special attention to labor-saving accessories, such as mechanical stokers. Proper care and operation of boilers of various types.

Machine Drawing: Preparation of detailed working drawings of all types of machines and parts. Special instruction in detailing cams, belts, gears, etc. Practical work in design, based upon familiar shop problems.

Mathematics: The acquisition, through practical problems, of a working knowledge of algebra as used in "short-cut" form-

ulas and rapid estimating. Simplifying mechanical problems by applying the principles of geometry and trigonometry.

Machine Design: Principles and methods of designing engines and machines for special purposes, with particular regard to the factor of safety. Careful discussion of the types of gearing, pulleys, gears, etc., most efficient under given conditions.

Steam Engines and Turbines: Selection of engines for particular work; their erection and economical operation, with a complete explanation of testing methods and apparatus. The different types of modern steam turbines; their design and operation, together with a discussion of their advantages and disadvantages for different kinds of work, as compared with reciprocating engines.

Engine Accessories: Different types of indicators, how to take cards, and how to use the results obtained in determining efficiency and trouble. Construction of valves, and the common types of gears used to operate them, with a description of special gears; the proper adjustment of gears for economy and efficiency with any given load and speed.

Compressed Air: The production, transmission, and use of compressed air in hammers, drills, and pneumatic tools of all sorts. How to operate a complete pneumatic power plant.

Gas and Oil Engines: Principles, design, and operation of this new type of power producers. Explains the use of different fuels, and discusses the types of engines best adapted to different purposes.

Locomotive Engines: The different types of locomotives, their design and economical operation. Handling a train on the road, and how to determine the rating for any given locomotive.

Air Brakes: The design and operation of the Westinghouse air-brake system, for both steam and electric trains, with a discussion of the train air signal, as used on steam and electric lines.

Elevators: Standard types of freight and passenger elevators, their proper design and operation. Discussion of accessories, cables, and safety devices. Consideration of hand and belt, steam and hydraulic, and electric elevators.

Refrigeration: The theory of refrigeration and cold storage, with a description of the common refrigeration systems. Design and operation of ice-making plants, with particular attention to the profitable operation of cold storage plants.

STEAM ENGINEERING

(Prepares for Steam Engineer's State License, Marine Engineer's Federal License, or position as Locomotive Engineer)

SUBJECTS FOR STUDY

(See outline, page 78)

The subjects covered by the course in Steam Engineering fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 78. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to steam engineering subjects. A review of the elements of physics, as used in determining strains and stresses. Elementary chemistry, necessary to an understanding of steam boilers.

Drawing: Practice in mechanical drawing and lettering, with particular attention to the production of working drawings.

Steam Principles: Elementary discussion of the theory and application of heat energy, and the types of boilers best adapted to conditions affecting different plants.

Boilers: Details of construction, with special attention to labor-saving accessories, such as mechanical stokers. Proper care and operation of boilers of various types.

Machine Drawing: Preparation of detailed working drawings of all types of machines and parts. Special instruction in detailing cams, belts, gears, etc. Practical work in design, based upon familiar shop problems.

STEAM ENGINEERING

Prepares for Steam Engineer's State License, Marine Engineer's Federal License, or position as Locomotive Engineer

54 TEXTBOOKS

NOTE: For detailed description of this course, see page 77. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject	Subject
Practical Mathematics Part I	Valve Gears
Practical Mathematics Part II	Compressed Air Part I
Practical Mathematics Part III	Compressed Air Part II
Practical Mathematics Part IV	Gas and Oil Engines Part I
Practical Physics Part I	Gas and Oil Engines Part II
Practical Physics Part II	Gas and Oil Engines Part III
Mechanical Drawing Part I	Gas-Producers
Mechanical Drawing Part II	Refrigeration Part I
Mechanical Drawing Part III	Refrigeration Part II
Construction of Boilers	Refrigeration Part III
Types of Boilers	Heating and Ventilation Part I
Heat	Heating and Ventilation Part II
Chemistry of Combustion	Heating and Ventilation Part III
Boiler Accessories	Elements of Electricity Part I
Boiler Practice	Elements of Electricity Part II
Mechanism	Elements of Electricity Part III
Machine Drawing Part I	Storage Batteries
*Machine Drawing Part II	Underwriters' Requirements Part I
*Machine Drawing Part III A	Underwriters' Requirements Part II
‡I { Steam Engines Part I	Electric Lighting
{ Steam Engines Part II	Types of Generators and Motors
{ Locomotive Boilers and Engines Part I	Part I
‡II { Locomotive Boilers and Engines Part II	Types of Generators and Motors
{ Air-Brakes Part I	Part II
{ Air-Brakes Part II	Management of Dynamo Electric Machinery Part I
{ Self-Propelled Railway Cars	Management of Dynamo Electric Machinery Part II
Pumps	Elevators Part I (Hand and Belt)
Steam Turbines Part I	Elevators Part II (Steam and Hydraulic)
Steam Turbines Part II	Elevators Part III (Electric)
Steam Engine Indicators	Elevators Part IV (Equipment)

*Optional work

‡The student will take only one of these two Groups, according to the branch of steam work in which he expects to specialize: Group I, for Stationary or Marine Engineering; Group II, for Locomotive Engineering. See page 72.

Textbooks and Tuition \$110.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

Steam Engines: Selection of engines for particular work; their erection and economical operation, with a complete explanation of testing methods and apparatus.

Locomotive Engines: The different types of locomotives, their design and economical operation. Handling a train on the road, and how to determine the rating for any given locomotive.

Air Brakes: The design and operation of the Westinghouse air-brake system, for both steam and electric trains, with a discussion of the train air signal, as used on steam and electric lines.

Steam Turbines: The different types of modern steam turbines; their design and operation, together with a discussion of their advantages and disadvantages for different kinds of work, as compared with reciprocating engines.

Engine Accessories: Different types of indicators, how to take cards, and how to use the results obtained in determining efficiency and trouble. Construction of valves, and the common types of gears used to operate them, with a description of special gears; the proper adjustment of gears for economy and efficiency with any given load and speed.

Compressed Air: The production, transmission, and use of compressed air in hammers, drills, and pneumatic tools of all sorts. How to operate a complete pneumatic power plant.

Gas and Oil Engines: Principles, design, and operation of this new type of power producers. Explains the use of different fuels, and discusses the types of engines best adapted to different purposes.

Refrigeration: The theory of refrigeration and cold storage, with a description of the common refrigeration systems. Design and operation of ice-making plants, with particular attention to the profitable operation of cold storage plants.

Heating and Ventilation: Standard systems of warming, and their relative advantages for houses, factories, public buildings, and office structures; with particular attention to vacuum

and low pressure systems. The proper design of boilers, heaters, pipes, and all accessories for various purposes.

Electrical Principles: Basic theories of the nature of electricity; terms used in electrical work; laws of energy, resistance, etc.

Electric Lighting: Installing convenient electric wiring and lighting systems in accordance with the fire underwriters' requirements.

Dynamos and Motors: Principles of construction and operation of machines for generating and applying electrical energy. Discussion of different types to meet different conditions and needs. Explanation of difference in principle and application of direct- and alternating-current machinery.

Management: Construction, installation, and operation of dynamo-electric machinery for all purposes. Approved methods of inspecting and testing, with particular attention to preventing, localizing, and remedying dynamo "trouble."

Elevators: Standard types of freight and passenger elevators, their proper design and operation. Discussion of accessories, cables, and safety devices. Consideration of hand and belt, steam and hydraulic, and electric elevators for different purposes.

SHOP PRACTICE

(Prepares for position as Shop Foreman)

SUBJECTS FOR STUDY

(See outline, page 82)

The subjects covered by the course in Shop Practice fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 82. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to the work of the machine shop and foundry. A review of the elements of physics, as used in determining strains and stresses.

Drawing: Practice in mechanical drawing and lettering, with particular attention to the production of working shop drawings.

Pattern Making: Use of materials and tools. Methods of making and finishing patterns for various machine parts.

Foundry Work and Forging: Selection and testing of different kinds of molding sand; making molds and cores of various kinds; approved methods of melting and pouring metals. Materials and methods employed in forging, with special attention to the advantages and disadvantages of standard methods of welding, including electric welding.

Machine-Shop Work: Use of standard tools, with a special discussion of the proper speeds for various kinds of metal. Detailed explanation of construction and operation of standard types of lathes, milling machines, etc., including special features of automatic machines. Approved methods of management for machine shops of various types and sizes; practical systems for shop records, time-keeping, etc.

Tool Making: Selection and tempering of steel for tools for different purposes. Designing and making machine tools of all types, and for all standard machines. Making punches and dies, and gages for measuring various angles and dimensions.

Compressed Air: The production, transmission, and use of compressed air in hammers, drills, and pneumatic tools of all sorts. How to operate a complete pneumatic power plant.

AUTOMOBILE COURSE

(Prepares for position as Chauffeur, Garage Keeper, or Repairman)

SUBJECTS FOR STUDY

(See outline, page 82)

SHOP PRACTICE

Prepares for position as Shop Foreman

29 TEXTBOOKS

NOTE: For detailed description of this course, see page 80. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject
Practical Mathematics Part I
Practical Mathematics Part II
Practical Mathematics Part III
Practical Mathematics Part IV
Practical Physics Part I
Practical Physics Part II
Mechanical Drawing Part I
Mechanical Drawing Part II
Mechanical Drawing Part III
Pattern Making Part I
Pattern Making Part II
Foundry Work Part I
Foundry Work Part II
Forging
Welding

Subject
Machine-Shop Work Part I
Machine-Shop Work Part II
Machine-Shop Work Part III
Machine-Shop Work Part IV
Machine-Shop Work Part V
Tool Making Part I
Tool Making Part II
Tool Making Part III
Compressed Air Part I
Compressed Air Part II
Mechanism
Machine Drawing Part I
*Machine Drawing Part II
*Machine Drawing Part III A

*Optional work

Textbooks and Tuition \$65.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

AUTOMOBILE COURSE

Prepares for position as Chauffeur, Garage Keeper, or Repairman

26 TEXTBOOKS

NOTE: For detailed description of this course, see page 81. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject
Practical Mathematics Part I
Practical Mathematics Part II
Practical Mathematics Part III
Practical Mathematics Part IV
Explosion Motors
Gasoline Automobiles Part I (Introductory—Engine Features)
Gasoline Automobiles Part II (Valves—Carbureters)
Gasoline Automobiles Part III (Transmissions)
Gasoline Automobiles Part IV (Chassis)
Gasoline Automobiles Part V (Steering and Running Gear)
Electrical Principles

Subject
Electrical Equipment Part I
Electrical Equipment Part II
Electric Automobiles Part I
Electric Automobiles Part II
Steam Automobiles
Types of Automobiles
Automobile Driving
Commercial Vehicles Part I
Commercial Vehicles Part II
Commercial Vehicles Part III
Commercial Vehicles Part IV
Commercial Vehicles Part V
Private Garages and Repairs
*Motorcycles and Cycle Cars—Light Cars
*Motor Boats

*Optional work

Textbooks and Tuition \$45.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

The subjects covered by the Automobile Course fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 82. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to automobile subjects.

Explosion Motors: Principles involved in the design, construction, and operation of internal explosion motors used in "gas" cars. How to determine engine efficiency, select fuels, and secure fuel economy.

Gasoline Automobiles: The proper design of all automobile parts. Adapts explosion motor principles to engine design; treats cooling, lubrication, carburetion, starters, transmission and transmission parts, the chassis and its design, and steering and running gear, wheels, tires, and rims.

Electrical Equipment: Includes a discussion of all forms of ignition systems, both high and low tension, magnetos and storage battery ignition alone and in combination; lighting systems, giving standard types and wiring methods; electric starters, giving types, wiring methods, and design data.

Electric Automobiles: The principles of electrical storage and electric motors, as applied to electric vehicles. Detailed treatment of the storage battery, the motor, control and driving, tires, and care of the car.

Steam Automobiles: The design and operation of steam automobiles; including generator and engine, special driving features, and the care of the car.

Types of Automobiles: Comparison of the different types of standard pleasure cars, gas, electric, and steam. How to select a car, for any particular purpose, that meets the requirements of the owner without too great an expense. How to judge the value of second-hand cars.

Automobile Driving: Proper methods of starting, driving, and stopping a car. How to operate a car economically, cut down tire bills, detect and repair trouble. How to avoid skidding.

Commercial Vehicles: Standard types of tractors, trucks, taxicabs, and delivery cars, large and small, gas and electric, and how to run them economically. Special designs for peculiar work, such as taxicabs, delivery wagons, omnibuses, fire apparatus, trailers, tractors, road trains, etc. How to choose the car best suited to the work to be done.

Private Garages and Repairs: How to maintain a private garage efficiently and economically. How to make repairs properly.

Motorcycles, Cycle Cars, Light Cars: Design and operation of standard motorcycles, and cycle cars, including motors, ignition, starting, gear shifts, etc.; with a consideration of the various types of cycle cars. Peculiarities of design, chassis, transmission, etc., of representative American light cars.

Motor Boats: Types of hulls and materials used. High- and slow-speed motors, with special attention to details peculiar to marine motors. Kinds of propeller wheels and steering gears. Prevention and correction of marine motor troubles. Terms, signals, and regulations that should be familiar to the motor boat operator.

FIRE PREVENTION AND INSURANCE DEPARTMENT

(Opened to students in 1910)

The courses offered in this Department are planned to prepare the student to hold well paid positions in either the insuring or the prevention branch of the fire insurance business, and to fit him eventually for the position of Inspector, Insurance Broker, Statistician, Rate Maker, or Special, Local, State, or General Agent.

Fire Prevention and Insurance: This complete course is recommended for every man engaged in any branch of fire insurance work who does not already possess a thorough and systematic knowledge of the subject. It is the only complete course in fire insurance branches offered by any school in the world. It covers both fire-resisting construction, and the principles and practice of fire insurance, including inspection, rating, adjusting, and underwriting.

Fires cost the United States millions of dollars and hundreds of lives every year. This total destruction of valuable property is a direct waste, which is not confined to the community in which the fire occurs, but affects the country at large. In consequence, cities are enacting stricter building codes, calling for more fireproof construction; and state and national governments maintain forest rangers, whose business it is to prevent disastrous forest fires. There is everywhere a growing demand for men who can reduce the chances of fires by applying to everyday problems the modern methods of fire prevention and fire protection. The man who possesses the training necessary to plan or do such work can find a well paid position either in the service of State or municipality, or in private life. The fire insurance companies are heartily in favor of this new movement, because they make their legitimate profit whether losses are high or low, by adjusting the premium to cover the risk.

Fire insurance, for many years to come, will be a gigantic business, employing thousands of people. The business is one of

the safest on earth, because complete records, extending back for years, enable the companies to know the proportionate number of buildings that will burn every year, and thus to estimate in advance the cost in paid insurance. The compilation of these statistics calls for the services of hundreds of skilled Computers, Statisticians, Tabulators, and Rate Makers. Further, the companies employ thousands of Inspectors, who determine, from its construction, use, and condition, what the chances are that any given building will burn; skilled Underwriters, who fix the rate of insurance according to the known risk and the possibilities of loss; Investigators, who examine into fires to make sure that there has been no fraud or incendiarism, and Agents who settle claims; besides the army of skilled Clerks, Salesmen, and Managers, who administer the routine business affairs of the companies.

Fire insurance work falls naturally into two great divisions: the prevention of fire, and the placing and adjusting of the insurance. This course gives a knowledge of the entire field, so that the student will understand the relation of the various specialized lines, and be able to choose wisely in which line he shall specialize. The work on fire prevention makes a careful study of all modern public and private fire-protection appliances, and gives particular attention to the possibilities in fire-resisting building construction. The work on fire insurance covers both the big general principles upon which the insurance business is based, and the manner in which these principles are applied to current insurance problems. The course prepares the student for an executive position in any branch of field or office work.

Fire Prevention: This short course in fireproof construction, and the principles and practice of public and private fire prevention, is recommended for Fire Insurance Inspectors, Field Workers, Architects, and Building Contractors. It prepares for a position as Fire Insurance Inspector.

Fire Insurance: This short course in the principles and practice of fire insurance is recommended for Fire Insurance Agents, Adjusters, and Office Workers. It prepares for a position as Insurance Broker or Local Agent.

FIRE PREVENTION AND INSURANCE

Prepares for an Executive Position in any branch of Field or
Office Work

31 TEXTBOOKS

NOTE: For detailed description of this course, see page 88. For
synopses of textbooks, see alphabetical list of subjects, page 153.

Subject	Subject
Practical Mathematics Part I	Fire Insurance Inspection Part II (Construction of Buildings)
Practical Mathematics Part II	Fire Insurance Inspection Part III (Private Fire Protection)
Practical Mathematics Part III	Fire Insurance Inspection Part IV (Public Fire Protection)
Practical Mathematics Part IV	Fire Insurance Inspection Part V (Public Fire Protection)
Practical Physics Part I	Fire Insurance Inspection Part VI (Common and Special Hazards)
Practical Physics Part II	Fire Insurance Rating Part I
Chemistry of Combustion	Fire Insurance Rating Part II
Fire and Fire Losses	Fire Insurance Rating Part III
Fireproof Construction Part I	Fire Insurance Law (Including Stand- ard Policy) Part I
Fireproof Construction Part II	Fire Insurance Law (Including Stand- ard Policy) Part II
Fireproof Construction Part III	Fire Insurance Law (Including Stand- ard Policy) Part III
Fireproof Construction Part IV	Settlement of Losses
Building Code	Fire Insurance Broker
Underwriters' Requirements for Safe Electrical Installations Part I	Fire Insurance Underwriting
Underwriters' Requirements for Safe Electrical Installations Part II	
Elements of Fire Insurance	
Fire Insurance Inspection Part I (Reports and Their Preparation)	

Textbooks and Tuition \$70.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

FIRE PREVENTION AND INSURANCE

(Prepares for an Executive Position in any branch of Field or Office Work)

SUBJECTS FOR STUDY

(See outline, page 87)

The subjects covered by the course in Fire Prevention and Insurance fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 87. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to fire insurance subjects. A review of the elements of physics, as used in determining strains and stresses.

Chemistry of Combustion: Fundamental principles of chemistry, upon which is based the science of fire prevention. Discussion of the fire hazard of dangerous manufacturing materials.

Fire Losses: What fires cost in value of buildings and material destroyed. What the great fires, such as that of San Francisco, teach concerning fireproofing, and the proper grouping of buildings to avoid the spread of conflagrations.

Elements of Fire Insurance: Consideration of economic principles upon which the fire insurance business is based, and the methods and organization of fire insurance companies.

Fireproof Construction: Design and construction of fireproof buildings for all purposes. Cost of fireproof construction compared with *per capita* cost in higher fire insurance premiums. How to erect safe and handsome buildings, with fireproof ornaments, stairs, floors, walls, and roof. Concrete as a fireproof material.

Building Code and Underwriters' Requirements: Building regulations, designed to insure safety and fireproof construction, as used by American cities. Rules for safe electrical installations, as approved by fire insurance companies. Construction of buildings which can be insured at a low rate.

Inspection Reports: Preparation of fire insurance inspectors' reports, with special attention to such important details as occupancy, sprinkler equipment, electrical conditions, etc. Use of diagrams to indicate details of building construction.

Building Construction: Consideration of standard types of building construction, with particular attention to details that affect the fire hazard. Special study of mill construction, as used in factories, storehouses, workshops, etc.

Private Fire Protection: Principles and installation of private fire protective devices of all standard types, with special attention to automatic sprinkler systems, chemical extinguishers, and alarm systems.

Public Fire Protection: Elementary hydraulic principles that affect public water supply. Systems of collection and distribution. Construction and operation of pumps of all standard types suitable to varying conditions. Organization and operation of public fire departments, with a consideration of municipal ordinances designed for fire protection.

Hazards: Consideration of the many different elements that increase the fire hazard. Special study of dangerous and extra hazardous risks peculiar to certain industries, such as celluloid manufactories, flour mills, inflammable waste, etc.

Rating: Principles and methods of establishing fire insurance rates, with a special study of the Universal and Dean Schedules. How fire insurance companies protect themselves when insuring a bad risk.

Fire Insurance Law: The laws governing the conduct of a fire insurance company; its rights and its liabilities to policy holders; how its funds must be invested. An exhaustive study of the different policies written by fire insurance companies.

Settling Losses: How losses are ascertained by the insuring company, and settled in accordance with the policy written. Adjustment of disputed claims. How companies protect themselves against fraud.

Brokerage: How the fire insurance broker, selling insurance

FIRE PREVENTION

Prepares for position as Fire Insurance Inspector

22 TEXTBOOKS

NOTE: For detailed description of this course, see page 91. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject	Subject
Practical Mathematics Part I	Underwriters' Requirements for Safe
Practical Mathematics Part II	Electrical Installations Part II
Practical Mathematics Part III	Elements of Fire Insurance
Practical Mathematics Part IV	Fire Insurance Inspection Part I
Practical Physics Part I	(Reports and Their Preparation)
Practical Physics Part II	Fire Insurance Inspection Part II
Chemistry of Combustion	(Construction of Buildings)
Fire and Fire Losses	Fire Insurance Inspection Part III
Fireproof Construction Part I	(Private Fire Protection)
Fireproof Construction Part II	Fire Insurance Inspection Part IV
Fireproof Construction Part III	(Public Fire Protection)
Fireproof Construction Part IV	Fire Insurance Inspection Part V
Building Code	(Public Fire Protection)
Underwriters' Requirements for Safe	Fire Insurance Inspection Part VI
Electrical Installations Part I	(Common and Special Hazards)

Textbooks and Tuition \$50.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

to the building owners, distributes risks on big buildings among several companies. Office methods, and business getting.

Underwriting: How the fire insurance underwriter discriminates between good and bad risks. Wide information necessary to successful underwriting.

FIRE PREVENTION

(Prepares for position as Fire Insurance Inspector)

SUBJECTS FOR STUDY

(See outline, page 90)

The subjects covered by the course in Fire Prevention fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 90. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to fire insurance subjects. A review of the elements of physics, as used in determining strains and stresses.

Chemistry of Combustion: Fundamental principles of chemistry, upon which is based the science of fire prevention. Discussion of the fire hazard of dangerous manufacturing materials.

Fire Losses: What fires cost in value of buildings and material destroyed. What the great fires, such as that of San Francisco, teach concerning fireproofing, and the proper grouping of buildings to avoid the spread of conflagrations.

Fireproof Construction: Design and construction of fireproof buildings for all purposes. Cost of fireproof construction compared with *per capita* cost in higher fire insurance premiums. How to erect safe and handsome buildings, with fireproof ornaments, stairs, floors, walls, and roof. Concrete as a fireproof material.

Building Code and Underwriters' Requirements: Building regulations, designed to insure safety and fireproof construction, as made by American cities. Rules for safe electrical installations,

as approved by fire insurance companies. Construction of buildings which can be insured at a low rate.

Elements of Fire Insurance: Consideration of economic principles upon which the fire insurance business is based, and the methods and organization of fire insurance companies.

Inspection Reports: Preparation of fire insurance inspectors' reports, with special attention to such important details as occupancy, sprinkler equipment, electrical conditions, etc. Use of diagrams to indicate details of building construction.

Building Construction: Consideration of standard types of building construction, with particular attention to details that affect the fire hazard. Special study of mill construction, as used in factories, storehouses, workshops, etc.

Private Fire Protection: Principles and installation of private fire protective devices of all standard types, with special attention to automatic sprinkler systems, chemical extinguishers, and alarm systems.

Public Fire Protection: Elementary hydraulic principles that affect public water supply. Systems of collection and distribution. Construction and operation of pumps of all standard types suitable to varying conditions. Organization and operation of public fire departments, with a consideration of municipal ordinances designed for fire protection.

Hazards: Consideration of the many different elements that increase the fire hazard. Special study of dangerous and extra hazardous risks peculiar to certain industries, such as celluloid manufactories, flour mills, inflammable waste, etc.

FIRE INSURANCE

(Prepares for position as Manager of Local Agency, or Adjuster)

SUBJECTS FOR STUDY

(See outline, page 93)

The subjects covered by the course in Fire Insurance fall generally under the main heads elaborated below. The relative

FIRE INSURANCE

Prepares for position as Manager of Local Agency, or Adjuster

20 TEXTBOOKS

NOTE: For detailed description of this course, see page 92. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject	Subject
*Practical Mathematics Part I	Fire Insurance Inspection Part VI (Common and Special Hazards)
*Practical Mathematics Part II	Fire Insurance Rating Part I
*Practical Mathematics Part III	Fire Insurance Rating Part II
*Practical Mathematics Part IV	Fire Insurance Rating Part III
Elements of Fire Insurance	Fire Insurance Law (Including Stand- ard Policy) Part I
Fire Insurance Inspection Part I (Reports and Their Preparation)	Fire Insurance Law (Including Stand- ard Policy) Part II
Fire Insurance Inspection Part II (Construction of Buildings)	Fire Insurance Law (Including Stand- ard Policy) Part III
Fire Insurance Inspection Part III (Private Fire Protection)	Settlement of Losses
Fire Insurance Inspection Part IV (Public Fire Protection)	Fire Insurance Broker
Fire Insurance Inspection Part V (Public Fire Protection)	Fire Insurance Underwriting

*Optional work

Textbooks and Tuition \$45.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

importance of these subjects, and the order in which they should be studied, are shown by the outline on page 93. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to fire insurance subjects. A review of the elements of physics, as used in determining strains and stresses.

Elements of Fire Insurance: Consideration of economic principles upon which the fire insurance business is based, and the methods and organization of fire insurance companies.

Inspection Reports: Preparation of fire insurance inspectors' reports, with special attention to such important details as occupancy, sprinkler equipment, 'electrical conditions, etc. Use of diagrams to indicate details of building construction.

Building Construction: Consideration of standard types of building construction, with particular attention to details that affect the fire hazard. Special study of mill construction, as used in factories, storehouses, workshops, etc.

Private Fire Protection: Principles and installation of private fire protective devices of all standard types, with special attention to automatic sprinkler systems, chemical extinguishers, and alarm systems.

Public Fire Protection: Elementary hydraulic principles that affect public water supply. Systems of collection and distribution. Construction and operation of pumps of all standard types suitable to varying conditions. Organization and operation of public fire departments, with a consideration of municipal ordinances designed for fire protection.

Hazards: Consideration of the many different elements that increase the fire hazard. Special study of dangerous and extra hazardous risks peculiar to certain industries, such as celluloid manufactories, flour mills, inflammable waste, etc.

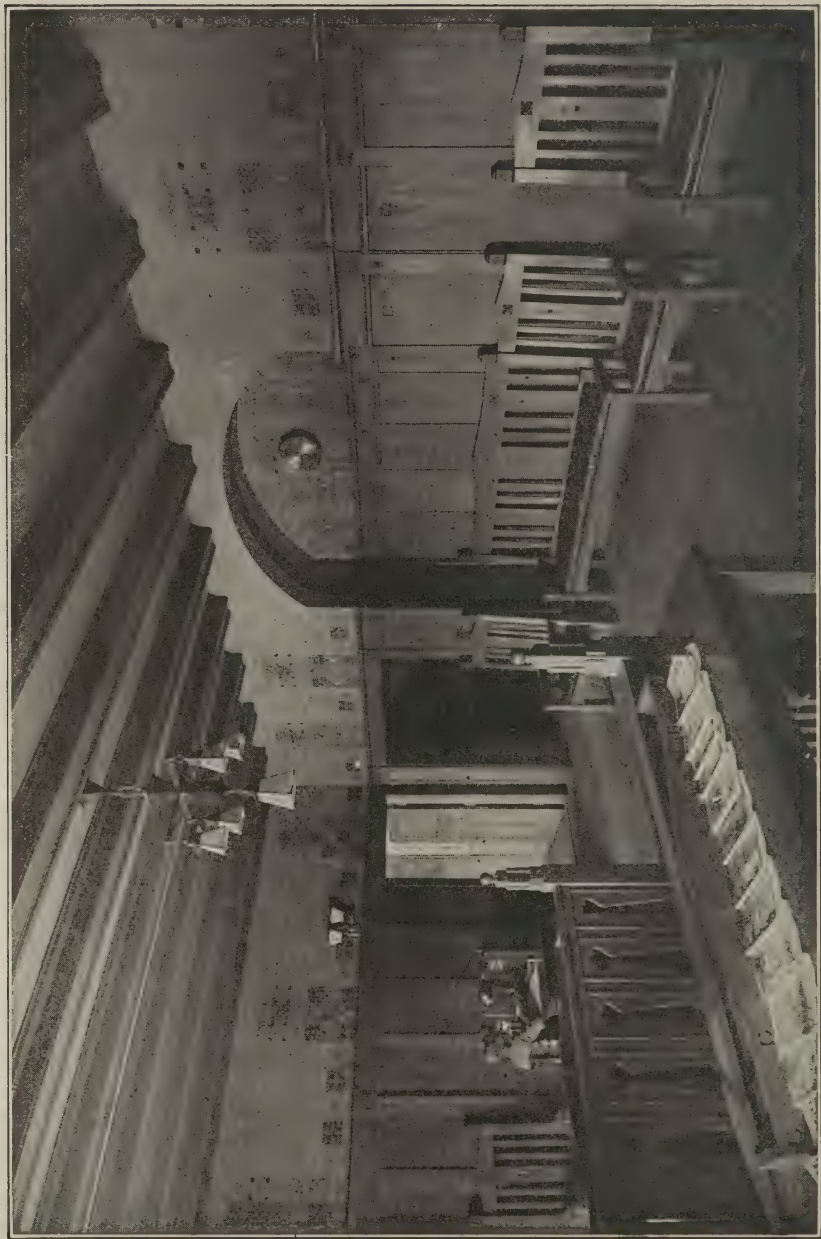
Rating: Principles and methods of establishing fire insurance rates, with a special study of the Universal and Dean Schedules. How fire insurance companies protect themselves when insuring a bad risk.

Fire Insurance Law: The laws governing the conduct of a fire insurance company; its rights and its liabilities to policy holders; how its funds must be invested. An exhaustive study of the different policies written by fire insurance companies.

Settling Losses: How losses are ascertained by the insuring company, and settled in accordance with the policy written. Adjustment of disputed claims. How companies protect themselves against fraud.

Brokerage: How the fire insurance broker, selling insurance to the building owners, distributes risks on big buildings among several companies. Office methods, and business getting.

Underwriting: How the fire insurance underwriter discriminates between good and bad risks. Wide information necessary to successful underwriting.



Entrance Hall, Administration Building, American School of Correspondence

HEATING AND VENTILATION ENGINEERING DEPARTMENT

(Opened to students in 1903)

The courses offered in this Department are planned to prepare the student to hold well paid positions in either the installing, designing, or inspection branch of house sanitation, and to fit him eventually for the position of Heating and Ventilation Engineer, Sanitary Inspector, or Master Plumber or Steamfitter.

Heating and Ventilation Engineering: This complete course is recommended for every man interested in general building work, or in any branch of house sanitation. The Heating and Ventilation Engineer is a specialist. His field is narrow, but his work is most important, for no building can be considered "safe" unless its heating, plumbing, and ventilating systems are carefully planned to provide for the health of its occupants. Just as the Architect guards against danger from fire or structural weakness, so the Heating and Ventilation Engineer takes measures preventive of typhoid, pneumonia, and other serious diseases that threaten house dwellers. The rapid advancement in bacteriological science, and in sanitary equipment, requires expert knowledge on the part of those designing, constructing, and supervising sanitary installations, and offers big opportunities to the man who keeps up-to-date. This course is particularly recommended for Plumbers, Steamfitters, and Sheet-Metal Workers who desire to get into bigger work. It prepares for a position as Heating and Ventilation Engineer, or Sanitary Inspector.

Heating, Ventilating, and Plumbing: This short course in the principles and installation of modern sanitary systems is recommended for Plumbers and Steamfitters who want to get to the head of their shop, or run their own shop. It prepares for a position as Master Plumber or Steamfitter.

HEATING AND VENTILATION ENGINEERING

Prepares for position as Heating and Ventilation Engineer, or
Sanitary Inspector

39 TEXTBOOKS

NOTE: For detailed description of this course, see page 99. For
synopses of textbooks, see alphabetical list of subjects, page 153.

Subject	Subject
Practical Mathematics Part I	Steam Engines Part I
Practical Mathematics Part II	Steam Engines Part II
Practical Mathematics Part III	Pumps
Practical Mathematics Part IV	Bacteriology and Sanitation
Practical Physics Part I	Plumbing Part I
Practical Physics Part II	Plumbing Part II
Plane Geometry	Plumbing Part III
Mechanical Drawing Part I	Elements of Electricity Part I
Mechanical Drawing Part II	Elements of Electricity Part II
Mechanical Drawing Part III	Elements of Electricity Part III
Construction of Boilers	Electric Lighting
Types of Boilers	Underwriters' Requirements Part I
Heat	Underwriters' Requirements Part II
Chemistry of Combustion	Machine Drawing Part I
Boiler Accessories	Tinsmithing
Boiler Practice	Sheet-Metal Work Part I
Heating and Ventilation Part I	Sheet-Metal Work Part II
Heating and Ventilation Part II	*Sheet-Metal Work Part III
Heating and Ventilation Part III	*Sheet-Metal Work Part IV
Steam and Hot-Water Fitting	

*Optional work

Textbooks and Tuition \$85.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

HEATING AND VENTILATION ENGINEERING

(Prepares for position as Heating and Ventilation Engineer, or
Sanitary Inspector)

SUBJECTS FOR STUDY

(See outline, page 98)

The subjects covered by the course in Heating and Ventilation Engineering fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 98. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to sanitary subjects. A review of the elements of physics, as used in determining strains and stresses. Fundamental work in plane geometry necessary in planning sanitation systems.

Drawing: Practice in mechanical drawing and lettering, with particular attention to the production of working drawings.

Boilers: Details of construction, with special attention to labor-saving accessories, such as mechanical stokers. Proper care and operation of boilers for heating systems of various types.

Heat: Elementary discussion of the theory and application of heat energy. Fundamental principles of chemistry, upon which is based the science of domestic sanitation.

Heating and Ventilation: Standard systems of warming, and their relative advantage for houses, factories, public buildings, and office structures; with particular attention to vacuum and low pressure systems. The proper design of boilers, heaters, pipes, and all accessories for various purposes.

Steamfitting: Selection and operation of boilers for steam and hot-water heating systems, with a comparative study of all standard systems, and their advantages for different purposes.

Steam Engines: Selection of engines for particular work; their erection and economical operation, with a complete expla-

nation of testing methods and apparatus. Construction and operation of hydraulic rams and steam pumps.

Sanitation: An elementary study of bacteriology, as it affects problems connected with water supply, sewage disposal, and the general health of a community.

Plumbing: The selection, installation, and operation of private sewerage systems, for city or country use.

Electrical Principles: Basic theories of the nature of electricity; terms used in electrical work; laws of energy, resistance, etc.

Electric Lighting: Installing convenient electric lighting systems in accordance with the fire underwriters' requirements.

Machine Drawing: The preparation of working drawings from designs, or from the subject to be reproduced.

Sheet-Metal Work: Practical problems in the construction of various standard articles of tinware. Methods of obtaining patterns for ventilators, various types of elbows, and other distinctive sheet-metal jobs; development of special problems showing possibilities of sheet-metal; designing skylights and cornices of all types.

HEATING, VENTILATING, AND PLUMBING

(Prepares for position as Master Plumber or Steamfitter)

SUBJECTS FOR STUDY

(See outline, page 101)

The subjects covered by the course in Heating, Ventilating, and Plumbing fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 101. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to sanitary subjects.

HEATING, VENTILATING, AND PLUMBING

Prepares for position as Master Plumber or Steamfitter

15 TEXTBOOKS

NOTE: For detailed description of this course, see page 100. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject	Subject
Practical Mathematics Part I	Heating and Ventilation Part II
Practical Mathematics Part II	Heating and Ventilation Part III
Practical Mathematics Part III	Steam and Hot-Water Fitting
Practical Mathematics Part IV	Bacteriology and Sanitation
Mechanical Drawing Part I	Plumbing Part I
Mechanical Drawing Part II	Plumbing Part II
Mechanical Drawing Part III	Plumbing Part III
Heating and Ventilation Part I	

Textbooks and Tuition \$35.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

Drawing: Practice in mechanical drawing and lettering, with particular attention to the production of working drawings.

Heating and Ventilation: Standard systems of warming, and their relative advantage for houses, factories, public buildings, and office structures, with particular attention to vacuum and low pressure systems. The proper design of boilers, heaters, pipes, and all accessories for various purposes.

Steamfitting: Selection and operation of boilers for steam and hot-water heating systems, with a comparative study of all standard systems, and their advantages for different purposes.

Sanitation: An elementary study of bacteriology, as it affects problems connected with water supply, sewage disposal, and the general health of a community.

Plumbing: The selection, installation, and operation of private sewerage systems, for city or country use.

STRUCTURAL DRAFTING

Prepares for position as Structural Designer or Draftsman

32 TEXTBOOKS

NOTE: For detailed description of this course, see page 104. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject	Subject
Practical Mathematics Part I	*Graphs
Practical Mathematics Part II	Strength of Materials Part I
Practical Mathematics Part III	Strength of Materials Part II
Practical Mathematics Part IV	Statics
Practical Physics Part I	Steel Construction Part I
Practical Physics Part II	Steel Construction Part II
Mechanical Drawing Part I	Steel Construction Part III
Mechanical Drawing Part II	Steel Construction Part IV
Mechanical Drawing Part III	Steel Construction Part V
Freehand Drawing	Estimating Part III (Steel)
Perspective Drawing	Roof Trusses
Algebra Part I	Structural Drafting Part I
Algebra Part II	Structural Drafting Part II
Plane Geometry	Practical Problems in Construction
Logarithmic Tables	Bridge Engineering Part I
Trigonometry	Bridge Engineering Part II

*Optional work

Textbooks and Tuition \$70.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

ARCHITECTURAL DESIGN

Prepares for position as Architectural Designer or Draftsman

19 TEXTBOOKS

NOTE: For detailed description of this course, see page 107. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject	Subject
Practical Mathematics Part I	Perspective Drawing
Practical Mathematics Part II	Shades and Shadows
Practical Mathematics Part III	Architectural Drawing Part I
Practical Mathematics Part IV	Architectural Drawing Part II
Plane Geometry	Rendering in Pen and Ink
Mechanical Drawing Part I	Study of the Orders Part I
Mechanical Drawing Part II	Study of the Orders Part II
Mechanical Drawing Part III	Study of the Orders Part III
Freehand Drawing	†Hamlin: History of Architecture
Architectural Lettering	

†Standard textbook

Textbooks and Tuition \$45.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

DRAWING AND DESIGN DEPARTMENT

(Opened to students in 1903)

The courses offered in this Department are planned to prepare the student to hold well paid positions in either the designing or the drafting branch of the various engineering professions. It is evident that, while the basic work of the Designer or Draftsman is the same in any line, the man who goes into structural work requires a different training from one who goes into sheet-metal work.

Structural Drafting: This complete course in the designing and drafting of structural steel work is recommended for Engineers, Builders, and Draftsmen who wish to specialize in structural steel work. It prepares for a position as Structural Designer or Draftsman. Compare with the course in Structural Engineering, page 52.

Machine Drawing and Design: This complete course in the designing and drafting of machines and engines is recommended for Machinists, Inventors, Factory Superintendents and Foremen, and others interested in the design of machines, engines, and electrical apparatus. It prepares for a position as Machine Designer, or Mechanical Draftsman. Compare with the courses in Mechanical Engineering, page 70, and Electrical Engineering, page 58.

Architectural Design: This complete course in the designing of frame buildings and architectural ornaments, and the preparation of exhibition drawings, is recommended for Architects and Draftsmen who wish a complete knowledge of architectural design. It prepares for a position as Architectural Designer or Draftsman. Compare with the course in Architecture, page 42.

Sheet-Metal Pattern Drafting: This complete course in the designing and drafting of light and heavy sheet-metal work is recommended for Plumbers, Tinsmiths, Roofers, Blacksmiths, Metal Workers, Boiler Makers, and Contractors. It prepares for a position as Sheet-Metal Designer or Draftsman. Compare with the course in Heating and Ventilation Engineering, page 98.

STRUCTURAL DRAFTING

(Prepares for position as Structural Designer or Draftsman)

SUBJECTS FOR STUDY

(See outline, page 102)

The subjects covered by the course in Structural Drafting fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 102. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to structural subjects. A review of the elements of physics, as used in determining strains and stresses.

Drawing: Practice in drawing and lettering, with particular attention to the production of working drawings of structural subjects. Special exercises in freehand and perspective drawing, as adapted to the Structural Designer's need to be able to make rough sketches, or to jot down ideas for special construction forms.

Mathematics: The acquisition, through practical problems, of a working knowledge of algebra as used in "short-cut" formulas and rapid estimating. Simplifying structural problems by applying the principles of geometry and trigonometry.

Steel Construction: Design and use of steel frames and details for buildings of all kinds, with particular attention to construction of the "skyscraper" type. Details involved in use of steel columns, girders, and roof trusses. Solving strains and stresses to make buildings safe.

Structural Drafting: Special instruction in detailing methods as used in the best organized structural drafting rooms. Consideration of typical structural problems, such as beams, roof trusses, girders, etc.

Bridge Engineering: Design and construction of steel bridges and bridge work for all purposes; with special attention to the development of trusses and the determination of the span.

MACHINE DRAWING AND DESIGN

(Prepares for position as Machine Designer, or Mechanical Draftsman)

SUBJECTS FOR STUDY

(See outline, page 106)

The subjects covered by the course in Machine Drawing and Design fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 106. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to mechanical subjects. A review of the elements of physics, as used in determining strains and stresses.

Drawing: Practice in drawing and lettering, with particular attention to the production of working drawings of mechanical and electrical subjects. Special exercises in freehand and perspective drawing, as adapted to the Machine Designer's need to be able to make rough sketches, or to jot down ideas for special designs.

Mechanism: Special study of transmission devices for various purposes.

Mathematics: The acquisition, through practical problems, of a working knowledge of algebra as used in "short-cut" formulas and rapid estimating. Simplifying mechanical problems by applying the principles of geometry and trigonometry.

Machine Design: Practical work in principles and methods of design, based upon problems involving pulleys, shafts, gears, etc.

Machine Drawing: Preparation of detailed working drawings of all types of machines and parts. Special instruction in detailing cams, belts, gears, etc. Practice in drawing electrical devices and apparatus. Perspective drawing for the Machine Designer.

MACHINE DRAWING AND DESIGN

Prepares for position as Machine Designer, or Mechanical Draftsman

24 TEXTBOOKS

NOTE: For detailed description of this course, see page 105. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject
Practical Mathematics Part I
Practical Mathematics Part II
Practical Mathematics Part III
Practical Mathematics Part IV
Practical Physics Part I
Practical Physics Part II
Mechanical Drawing Part I
Mechanical Drawing Part II
Lettering
*Freehand Drawing
Mechanical Drawing Part III
Machine Drawing Part I

Subject
Mechanism
Algebra Part I
Algebra Part II
Plane Geometry
Logarithmic Tables
Trigonometry
Machine Design Part I
Machine Design Part II
Machine Drawing Part II
Machine Drawing Part III A
Machine Drawing Part III B
Perspective Drawing

*Optional work

Textbooks and Tuition \$55.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

SHEET-METAL PATTERN DRAFTING

Prepares for position as Sheet-Metal Designer or Draftsman

15 TEXTBOOKS

NOTE: For detailed description of this course, see page 107. For synopses of textbooks, see alphabetical list of subjects, page 153.

Subject
Practical Mathematics Part I
Practical Mathematics Part II
Practical Mathematics Part III
Practical Mathematics Part IV
Mechanical Drawing Part I
Mechanical Drawing Part II
Mechanical Drawing Part III
Machine Drawing Part I

Subject
Tinsmithing
Sheet-Metal Work Part I
Sheet-Metal Work Part II
Sheet-Metal Work Part III
Sheet-Metal Work Part IV
*Construction of Boilers
*Types of Boilers

*Optional work

Textbooks and Tuition \$35.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

ARCHITECTURAL DESIGN

(Prepares for position as Architectural Designer or Draftsman)

SUBJECTS FOR STUDY

(See outline, page 102)

The subjects covered by the course in Architectural Design fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 102. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to architectural subjects. A review of the elements of physics, as used in determining strains and stresses.

Drawing: Practice in drawing and lettering, with particular attention to the production of working drawings of architectural subjects. Special exercises in freehand and perspective drawing, as adapted to the Architectural Designer's need to be able to make rough sketches, or to jot down ideas to meet special building conditions.

Shades and Shadows: Finding and reproducing shadows of various architectural details, as used in construction of exhibition drawings.

Architectural Drawing: Practice in wash and water color work, as used in production of exhibition drawings. Study of design of modern frame buildings of usual types.

Rendering: Materials and methods used to reproduce different effects of light and shade.

Study of the Orders: An analytical study of the history and development of the classical orders of architecture upon which modern architectural design is based.

SHEET-METAL PATTERN DRAFTING

(Prepares for position as Sheet-Metal Designer or Draftsman)

SUBJECTS FOR STUDY

(See outline, page 106)

The subjects covered by the course in Sheet-Metal Pattern Drafting fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 106. For detailed synopsis of any subject, see alphabetical list beginning on page 153.

Elementary: A review of simple mathematical principles, as applied to sheet-metal work.

Drawing: Practice in mechanical drawing and lettering, with particular attention to the production of working drawings.

Sheet-Metal Work: Practical problems in the construction of various standard articles of tinware. Methods of obtaining patterns for ventilators, various types of elbows, and other distinctive sheet-metal jobs; development of special problems showing possibilities of sheet metal; designing skylights and cornices of all types.

Boilers: Details of construction, and use of machine and hand tools in boiler making. Types of boilers of various standard classes.

LAW DEPARTMENT

(Opened to students in 1912)

The courses offered in this Department are planned either to prepare the student for the practice of law in any State in the Union, or to inform the business man concerning the rights, duties, and liabilities affecting business transactions, so that he may know how to guard himself and his concern from law suits, and from the losses and inconveniences arising from ignorance of the law. The legal knowledge required for either purpose is the same; but the student who intends to practice law requires in addition a knowledge of court practice and procedure that would be useless to the student who is reading law for business purposes. The latter does not desire to be able to "try his own case"; he is fitting himself to handle ordinary legal questions, and to confer intelligently in more difficult cases with the practicing lawyer.

Complete Law: This course is recommended for every man who wants to practice law, or to have a thorough knowledge of law for his own guidance and protection. There is today a growing demand for legally trained men, both to practice at the bar, and to fill positions of responsibility and trust in every line of business. Many men of legal training have chosen law as a profession; but perhaps more are engaged in commercial and mercantile pursuits, using their legal knowledge in the advancement of their business. The heads of many of the large corporations of the country were educated as lawyers. Business men, and men who have any responsibilities, need a working knowledge of the law to prevent them from making serious mistakes.

This course will fit the student to pass the bar examination of any State in the Union. In any case where the subjects listed do not quite answer State requirements, the School will give the additional instruction necessary to meet these special requirements; except, of course, that it cannot take up in detail the statutes peculiar to each State. The American School guarantees that any student, who fails to pass the bar examination after completing this course, will be given free the special instruction and coaching

necessary to enable him to pass the subjects (except State Statutes) in which he was deficient. The method of instruction unites the textbook method with the case system, first introduced at Harvard University, and since adopted in modified form by many law schools. This combination enables the student to gain a broad knowledge of the law, and also gives him the ability to "think legally" — that is, reason along legal lines — as the result of his study of hypothetical and actual cases.

In order to give the student thorough and practical legal training, the School supplies to him free, in addition to his textbooks, thirty-six case books, which cover important leading cases in each subject of the law. These cases present the law to the student in the form in which it would come to him in actual practice, and thus enable him to put into practical application, during his course, the principles that he has learned from his textbooks. These case books also include an excellent glossary covering each subject under discussion, and standard legal forms where forms are used.

As an additional part of its practical instruction, the School gives the advanced student a course in legal practice. This is accomplished by giving the student legal problems such as are brought into the lawyer's office by the client. Upon a given statement of facts, the student is required to explain what course he would advise his client to take; to outline the various steps which must be taken to enable the client to know whether to proceed or not; and to prepare legal papers, in the form of contracts, deeds, leases, bills of sale, powers of attorney, wills, options, assignments, releases, etc., such as a lawyer would use in the preparation of his cases.

This application of legal principles to actual practice methods culminates in the "practice court" work offered during the last period of the course. The student is given cases in law and equity, in which he must draw all the necessary papers, and file his pleadings as though he were in actual practice at the bar. He files his praecipe and summons, and draws a declaration which must contain every element of fact necessary to show a right on the part of the plaintiff and a corresponding liability on the part of the defendant. He also draws up a copy of the pleading to be filed in a court of record, which sets forth the plaintiff's claims, together

with citations from leading cases and points of law substantiating the claims. The case is opened, the student produces his testimony, and makes the argument in which he offers opinions of law on the statement of facts assigned. He argues his case as though he were before the court or jury. Thus, when he has been admitted to the bar, the American School student does not need to spend a year in a lawyer's office to learn court practice and procedure, but can at once engage in active practice for himself. This practice work is not required of students taking law for business purposes.

The student in Complete Law is expected to take the Required Subjects in the order given, and then to elect that one of the six Groups in which he desires to specialize; he is urged not to make his election too early in his course, but to wait until he can be guided by his knowledge of general law. The Required Subjects cover the general legal knowledge required to pass the bar examinations; each of the six Groups gives specialized knowledge of one of the great subdivisions of law. Group I prepares for the work of a criminal lawyer, and general court practice. Group II prepares for the work of the corporation or trust company lawyer, and is particularly recommended for the business man who desires to learn the fundamental legal principles underlying business; the optional subjects are included especially for bankers and trust company officers. Group III prepares for work in the irrigation and mining districts, and is particularly recommended to students living west of the Mississippi River. Group IV makes a special study of the laws affecting maritime commerce, and is recommended for students in the principal ports. Group V prepares for the work of the patent lawyer, and is recommended for men in the engineering and manufacturing professions who take up law. Group VI prepares for the work of the real estate lawyer, and is recommended for real estate agents and property owners.

The bar admission requirements of the different States vary too greatly to be classified. Some States prescribe a certain term of study and office practice; others stipulate only that the applicant shall have a general knowledge of law; while many now require the applicant to prove that he has had a high school education, or its equivalent, before he will be admitted to the examination. (The College Preparatory Course, page 146, is a full "equivalent.")

All students intending to be admitted to the bar are advised to register, at the beginning of the course, in the office of some practicing attorney, in order that he may certify as to the time spent in study, and the applicant's other attainments, as required by law. Students desiring to practice law in the Dominion of Canada will find that the Complete Law course meets the Canadian requirements in all Provinces where the English common law prevails, except on the subjects of local statutes, corporations, and real property. All students purposing to practice law can obtain specific information regarding the requirements they must meet by advising the School in what State or Province they desire to practice.

Business Law: This short course is recommended for every business man, and for bankers, trust company officers, cashiers, bank clerks, etc., who do not feel that they have the time to take the complete course. It is planned to give the student a thorough knowledge of the laws affecting business transactions and financial institutions, without requiring him to go into general law, or the technicalities of court procedure. It prepares the student to hold any of the positions of responsibility and trust for which legal knowledge is desirable or necessary.

Real Estate Law: This short course is recommended for real estate agents, property owners, and business men, who desire a practical knowledge of the law pertaining to the owning, transferring, or handling of real property. It prepares the student to handle the ordinary legal problems that are constantly coming up in real estate offices, or to protect his own property and interests without being obliged to consult a lawyer at every step.

COMPLETE LAW

(Prepares for Bar Examination in any State, or for any position
requiring a knowledge of Law)

SUBJECTS FOR STUDY

(See outline, pages 114 and 115)

The *Required Subjects* covered by the course in Complete Law should be studied in the order shown by the outline on page

114. For detailed synopsis of any subject, see alphabetical list beginning on page 199.

Persons: Treats the fundamental rights of liberty and security as guaranteed by the law to citizens, aliens, infants, etc. Considers marriage and divorce, the rights of the husband to control the wife's property, and his liability for her debts. The relations of parent and child, guardian and ward, master and servant. The rights of persons under mental disability, as lunatics and idiots.

Contracts: What constitutes a valid contract at law. How a contract is interpreted and enforced, when the law modifies or nullifies it, and how the obligation is ended.

Criminal Law: State control over the personal actions of citizens. What constitutes a crime; what acts are criminal; the intent necessary for a crime. Excuses accepted by the law. How far and when parties to a crime are liable to punishment.

Torts: Private or civil wrongs or injuries for which the law gives the injured party redress. The different torts, as trespass against person and property, defamation, deceit, and unfair business dealings, together with the different liabilities to punishment.

Agency: How a man (the "principal") transacts business, or incurs liability, through another (his "agent"). How men become bound without knowing it by the act of an agent. The rights of those who deal with an agent against his principal; the mutual rights of agent and principal. How the relation is terminated.

Personal Property: Distinguishes personal property, or chattels — as tools, furniture, stocks and bonds, money, etc. — from real property, or land. Different kinds of personal property; how rights in them are created and transferred. How to protect property rights.

Sales: When the sale of chattels and goods is valid and binding; when orders may be canceled. Duties and liabilities of buyer and seller. When risks due to transportation are placed upon buyer or seller.

COMPLETE LAW

**Prepares for Bar Examination in any State, or for any position
requiring a knowledge of Law**

60 TEXTBOOKS

NOTE: For detailed description of this course, see page 112. For
synopses of textbooks, see alphabetical list of subjects, page 199.

Subject	Subject
Persons Part I	Mortgages, Chattel and Real Part I
Persons Part II	Wills and Administration of Estates Part I
Contract Part I	Wills and Administration of Estates Part II
Contract Part II	Title to Estates
Criminal Law Part I	Damages
Criminal Law Part II	Equity Part I
Torts Part I	Equity Part II
Torts Part II	Equity Part III
Torts Part III	Equity, Pleading and Practice
Torts Part IV	Trusts and Duties of Trustees
Agency Part I	Common Law Pleading and Practice Part I
Agency Part II	Common Law Pleading and Practice Part II
Personal Property	Common Law Pleading and Practice Part III
Sales Part I	Evidence Part I
Sales Part II	Evidence Part II
Private Corporations Part I	Constitution of the United States Part I
Private Corporations Part II	Constitution of the United States Part II
Private Corporations Part III	Constitution of the United States Part III
Partnership	Legal Ethics
Bills, Notes, and Checks Part I	
Bills, Notes, and Checks Part II	
Real Property Part I	
Real Property Part II	
Real Property Part III	
Real Property Part IV	

GROUP I (Pleading and Practice)

Criminal Pleading and Practice	Federal Law and Federal Courts
Medical Jurisprudence	Federal Procedure
Legal History and Law Reform	State Constitutions and Statutory Laws
Extraordinary Legal Remedies	Appellate Court Procedure
Conflict of Laws Part I	Office Practice
Conflict of Laws Part II	*Public Officers
Code Pleading and Practice	Law Books and How to Use Them
Commercial Accounts as Evidence	Philosophy of the Law
Actions at Law and Suits in Equity	

*Optional work

GROUP II (Business Law)

Subject	Subject
Bailments	Insurance Law Part I
Guaranty and Suretyship	Insurance Law Part II
Liens	Common Carriers Part I
Mortgages, Chattel and Real Part II	Common Carriers Part II
Landlord and Tenant	Municipal Corporations
Corporate Suretyship	*Interstate Commerce Law
*Banks and Banking Laws	Liberty of Contract and Labor Laws
*Bankruptcy	Quasi-Contracts

GROUP III (Irrigation and Mining Law)

Subject	Subject
Irrigation Law	Negligence
Landlord and Tenant	Liens
Mortgages, Chattel and Real Part II	Liberty of Contract and Labor Laws
Mining Law	Insurance Law Part I
Bailments	Insurance Law Part II
Quasi-Contracts	State Constitutions and Statutory Laws
Conveyancing and Abstracts	

GROUP IV (Admiralty and Shipping Law)

Subject	Subject
Shipping	Conflict of Laws Part I
Admiralty Law	Conflict of Laws Part II
Common Carriers Part I	Liens
Common Carriers Part II	Bailments
Interstate Commerce Law	Insurance Law Part I
Federal Law and Federal Courts	Insurance Law Part II
Federal Procedure	International Law

GROUP V (Patent and Copyright Law)

Subject	Subject
Trade-Marks and Trade-Names	Extraordinary Legal Remedies
Patents	Liberty of Contract and Labor Laws
Copyright	Mortgages, Chattel and Real Part II
Federal Law and Federal Courts	Bailments
International Law	Liens
Insurance Law Part I	Quasi-Contracts
Insurance Law Part II	Actions at Law and Suits in Equity

GROUP VI (Real Estate Law)

Subject	Subject
Landlord and Tenant	Conveyancing and Abstracts
Mortgages, Chattel and Real Part II	Guaranty and Suretyship
Bailments	Corporate Suretyship
Liens	Municipal Corporations
Insurance Law Part I	Commercial Accounts as Evidence
Insurance Law Part II	Liberty of Contract and Labor Laws
Quasi-Contracts	Bankruptcy
Negligence	

*Optional work

Textbooks and Tuition \$185.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

Private Corporations: Nature and rights of the artificial "person" known as a corporation. How corporations are formed and dissolved; their powers, rights, and liabilities; the conduct of their affairs. Their rights to do business in States other than those in which they are chartered.

Partnership: The conduct of business by partners. Their duties and responsibilities to each other, and to third persons. Compared with corporate organization.

Bills, Notes, Checks: "Commercial paper" — promissory notes, bonds, checks, drafts, and other orders for money. The nature of the different forms of paper, the different obligations created; when they may be transferred, and how discharged.

Real Property: The different kinds of rights in land; how created, transferred, and destroyed, by gift, sale, or will. The nature of future interests in land.

Mortgages: How land or personal property may be pledged for the payment of money. How the mortgage is made and foreclosed or discharged. How and when mortgaged property can be transferred by the owner.

Wills and Estates: Transferring property by devise and bequest. How the will must be drawn to be valid. The rights of heirs; how the will is carried into effect. Results when the will is invalid.

Titles: The nature of a man's rights in land, under different kinds of ownership. How these rights are created, transferred, and destroyed.

Damages: How the law compels men, by the payment of damages, to recompense those whom they have wronged. When excessive damages are allowed as punishment. When the rights to different kinds of damages arise, and how enforced.

Equity: The system of law developed to give justice where ordinary legal remedies and principles are inadequate or unfair. When equity helps a man whose ordinary legal remedy is inadequate. How men are protected when the law has been used to gain an unfair advantage or power over them.

Equity, Pleading and Practice: Procedure fixed for conducting a suit in equity.

Trusts and Trustees: The rights of different parties when one man controls property as guardian of child holding property, trustee managing an estate for the heirs, etc. How children, wards, and purchasers of property are protected against fraud, embezzlement, and bad faith.

Common Law Pleading: Method of bringing a suit up for trial. The system of accusations, answers, denials, and excuses, which sifts the questions that are to be settled on trial.

Evidence: What may be introduced in court to prove a contention. The testimony of witnesses, the introduction of written and documentary evidence, etc. Rules governing examination and cross-examination.

Constitution of the United States: A consideration of the supreme law of the land. How the many provisions of the Federal Constitution are applied in determining the rights of parties, the validity of laws, etc.

Legal Ethics: Duties of the Lawyer to his clients, to the courts, and to the public.

The *Optional Subjects* concluding the course in Complete Law should be studied in the order shown by the Group outlines on pages 114 and 115. To avoid much repetition, the subjects are described here in alphabetical order, regardless of the Groups in which they appear. For detailed synopsis of any subject, see alphabetical list beginning on page 199.

Actions in Law and Equity: How to conduct cases in each division of the courts, with detailed information that is valuable to the practicing Attorney.

Admiralty and Shipping: How the law classifies vessels and cargoes; what constitutes a voyage that satisfies contracts and shipping laws. The implied warranty of seaworthiness that every shipowner makes in accepting cargo; other understood conditions

concerning ship and cargo. The rights of passengers and crew, procedure in admiralty courts, and liens on vessels.

Appellate Court Procedure: The method and right to appeal a case from a lower court. On what grounds appeals may be taken, what results may be expected, and how the appealed case finally is decided.

Bailments: The special rights in personal property of a man (the "bailee") with whom the property has been placed for storage or repair by the owner. The rights of the owner against a bailee who attempts to misuse the property placed in his care; as baggage placed with a railroad, or a watch with a jeweler.

Bankruptcy: The method by which the property of a man hopelessly in debt is divided among his creditors, as justly as possible, in satisfaction of his debts; and how he then is discharged from further liability. How the affairs of bankrupt corporations are handled by a Receiver.

Banks and Banking Laws: Discusses state and national banks. The nature of the banking business; the rights of depositors; the nature and operations of clearing houses and trust companies.

Code Pleading and Practice: In most States, the old common law method of conducting a case, inherited from colonial days, has been superseded by a definite method regulated by the Code of Civil Procedure, which is here described.

Commercial Accounts as Evidence: How accounts and books of companies and firms are used as evidence in trials.

Common Carriers: The rights, duties, and liabilities of railroads as carriers of passengers and freight; telephone and telegraph companies, express companies, steamship lines, etc. The government's right to regulate rates. How to collect for damages caused by wreck or delay. The laws governing illegal combinations, rebates, etc.

Conflict of Laws: Treats of the law which governs when a man is subjected to opposing laws, by possessing property in another

State, the conflict of military or naval forces with the civil authorities, etc.

Conveyancing and Abstracts: The preparation of a copy of the title deeds and records, called an abstract of title, to property. The exact language and form of different instruments or papers concerned with the transfer of land.

Corporate Suretyship: The rights, duties, and liabilities of companies engaging in suretyship as a business.

Criminal Pleading and Practice: The conduct of cases of criminal prosecution; including arrest, bringing the case before the court by indictment, the trial, and proceedings after verdict.

Extraordinary Legal Remedies: How the law gives relief in cases where ordinary remedies, such as damages, are useless. Covers *mandamus*, where a man or public officer is compelled to do his duty under a contract or law; *prohibition*, restraining a man or officer from doing some contemplated act; *habeas corpus*, whereby police officers or others are compelled either to show just cause why a man should remain locked up, or to release him; *quo warranto*, whereby a public officer is compelled to justify his election or his official acts.

Federal Law, Courts, Procedure: A detailed treatment of Federal Law, and additional study of the Federal Constitution, and the functions and methods of the Federal Courts.

Guaranty and Suretyship: The system whereby a man or a company agrees to make good to a third party any losses occasioned to him by another, as when a surety company "goes on the bond" of a bank clerk. Discusses the rights of all parties concerned in such agreements.

Insurance: The general principles of fire, life, casualty, and marine insurance, and the laws governing the business. The rights, duties, and liabilities of the company; how the amount of damage is determined; how claims for and against the company are collected.

International Law: Treats of the origin and growth of the law which is followed by civilized nations in their dealings with each

other. The rights of citizens, aliens, and their properties, in time of peace and war; how damages for injuries done are awarded.

Interstate Commerce Law: Explains the constitutional basis of the law. The power of Congress to regulate foreign and domestic commerce. State control and taxation of properties.

Irrigation Law: The nature of water rights, both riparian and in stream and underground water. Claims for damages that arise for use of water for irrigation, and how they are adjusted. The fundamental law governing all irrigation and reclamation work.

Landlord and Tenant: The various kinds of agreements between landlord and tenant as to use of property, and how the responsibility for repairs and injuries is determined. The nature of eviction; and the legal remedies for the collection of rent, and recovery of property removed from the premises by the tenant.

Law Books, How to Use Them: The use of statutes, and reports of cases, in preparing cases. How to look up precedents. The relative value of decisions and precedents of different sorts.

Legal History; Law Reform: Gives a detailed history of the growth of English and American law. Outlines the tendencies of the present day, and indicates probable changes in the law.

Liberty of Contract; Labor Laws: What kind of valid contracts the law allows a laborer to make, and what contracts will not be enforced because of illegality. How far the law allows a laborer to "sign away" his rights, and when it intervenes to set aside unfair agreements. The law relating to the relations of labor unions and employers; what boycotts are permitted, what strike methods are illegal.

Liens: The rights of "bailees" of goods to hold them against the owner as security for payment of debts, and rights to attach chattels or land for the same purpose; as when a hotel holds baggage until the guest's bills are paid. How the law creates a lien; how the right comes to an end. Special liens, as mechanic's lien on land, etc.

Medical Jurisprudence: Covers cases where the law calls upon the physician and surgeon to give evidence. Treats of death, and

how to ascertain its cause; poisons and their effects; insanity, and how it is determined, etc.

Mining Law: The intricate subject of acquiring rights to mine. The rules regarding the right to follow the lode or vein, location of placer claims, and obtaining patents for mineral lands.

Municipal Corporations: The creation and abolition of city government. The powers, duties, and responsibilities of the municipal corporation. The use of the police power of the city; how city property and contracts are handled; how debts for work done are collected from the city.

Negligence: The different forms of negligence, and when, how, and to what extent they create liability. Contributory negligence, and application of the rules concerning negligence to cases of liability of the employer for accidents to employees.

Office Practice: Approved methods of conducting a law office. How to prepare legal papers. How to administer the business affairs of a law firm.

Patents and Copyrights: The nature of the protection of an inventor's or author's right to the exclusive sale of his work. How it is obtained, and how the law secures and enforces it.

Philosophy of the Law: The different theories of the origin and growth of law.

Public Officers: Conditions which constitute eligibility for public office, mode of election and retirement, tenure of office. What public officers may and may not do in the exercise of their offices.

Quasi-Contracts: How the law compels a man to be fair in his dealings, even though no contract exists — as when a man must return excess money, if he has been overpaid. How the law “implies” an agreement or contract to repay, and then enforces this “implied” or quasi-contract.

State Constitutions and Statutory Laws: Describes rights in property and under contract under the constitutions and laws of States, explaining the variations in the law, and its enforcement.

BUSINESS LAW

**Gives legal training necessary to Bankers, Trust Company
Officers, Cashiers, Bank Clerks, and Business
Men generally**

26 TEXTBOOKS

NOTE: For detailed description of this course, see page 123. For synopses of textbooks, see alphabetical list of subjects, page 199.

Subject	Subject
Contract I	Bills, Notes, and Checks II
Contract II	Guaranty and Suretyship
Quasi-Contracts	Private Corporations I
Sales I	Private Corporations II
Sales II	Private Corporations III
Agency I	Banks and Banking Laws
Agency II	Mortgages I
Partnership	Mortgages II
Bailments	Bankruptcy
Damages	Liens
Common Carriers I	Landlord and Tenant
Common Carriers II	*Trusts and Duties of Trustees
Bills, Notes, and Checks I	*Interstate Commerce Law

*Optional work

Textbooks and Tuition \$85.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

Trade-Marks, Names, Unfair Trade: How the right to use trade-marks is protected and limited, and how they are distinguished from trade names. What constitutes unfair trade, and how the law gives protection against it.

BUSINESS LAW

(Gives legal training necessary to Bankers, Trust Company Officers, Cashiers, Bank Clerks, and Business Men generally)

SUBJECTS FOR STUDY

(See outline, page 122)

The subjects covered by the course in Business Law include only those which are necessary for an understanding of the legal side of business transactions. The order in which they should be studied is shown by the outline on page 122. For detailed synopsis of any subject, see alphabetical list beginning on page 199.

Contracts: What constitutes a valid contract at law. How a contract is interpreted and enforced, when the law modifies or nullifies it, and how the obligation is ended.

Quasi-Contracts: How the law compels a man to be fair in his dealings, even though no contract exists — as when a man must return excess money, if he has been overpaid. How the law “implies” an agreement or contract to repay, and then enforces this “implied” or quasi-contract.

Sales: When the sale of chattels and goods is valid and binding; when orders may be canceled. Duties and liabilities of buyer and seller. When risks due to transportation are placed upon buyer or seller; how to avoid undue loss from this cause.

Agency: How a man (the “principal”) transacts business, or incurs liability, through another (his “agent”). How men become bound, without knowing it, by the act of an agent. The rights of those who deal with an agent against his principal; the mutual rights of agent and principal. How the relation is terminated. How to avoid losses due to “crooked” agents.

Partnership: The conduct of business by partners. Their duties and responsibilities to each other, and to third persons. Compared with corporate organization.

Bailments: The special rights in personal property of a man (the "bailee") with whom the property has been placed for storage or repair by the owner. The rights of the owner against a bailee who attempts to misuse the property placed in his care; as baggage placed with a railroad, or a watch with a jeweler.

Damages: How the law compels men, by the payment of damages, to recompense those whom they have wronged. When excessive damages are allowed as punishment. When the rights to different kinds of damages arise, and how enforced.

Common Carriers: The rights, duties, and liabilities of railroads as carriers of passengers and freight; telephone and telegraph companies, express companies, steamship lines, etc. The government's right to regulate rates. How to collect for damages caused by wreck or delay. The law governing illegal combinations, rebates, etc.

Bills, Notes, Checks: "Commercial paper" — promissory notes, bonds, checks, drafts, and other orders for money. The nature of the different forms of paper, the different obligations created; when they may be transferred, and how discharged.

Guaranty and Suretyship: The system whereby a man or a company agrees to make good to a third party any losses occasioned to him by another, as when a surety company "goes on the bond" of a bank clerk. Discusses the rights of all parties concerned in such agreements.

Private Corporations: Nature and rights of the artificial "person" known as a corporation. How corporations are formed and dissolved; their powers, rights, and liabilities; the conduct of their affairs. Their rights to do business in States other than those in which they are chartered.

Banks and Banking Laws: Discusses state and national banks. The nature of the banking business; the rights of depositors; the nature and operations of clearing houses and trust companies.

Mortgages: How land or personal property may be pledged for the payment of money. How the mortgage is made and foreclosed or discharged. How and when mortgaged property can be transferred by the owner.

Bankruptcy: The method by which the property of a man hopelessly in debt is divided among his creditors, as justly as possible, in satisfaction of his debts; and how he then is discharged from further liability. How the affairs of bankrupt corporations are handled by a Receiver.

Liens: The rights of "bailees" of goods to hold them against the owner as security for payment of debts, and rights to attach chattels or land for the same purpose; as when a hotel holds baggage until the guest's bills are paid. How the law creates a lien; how the right comes to an end. Special liens, as mechanic's lien on land, etc.

Landlord and Tenant: The various kinds of agreements between landlord and tenant as to use of property, and how the responsibility for repairs and injuries is determined. The nature of eviction; and the legal remedies for the collection of rent, and recovery of property removed from the premises by the tenant.

Trusts and Trustees: The rights of different parties when one man controls property as guardian of child holding property, trustee managing an estate for the heirs, etc. How children, wards, and purchasers of property are protected against fraud, embezzlement, and bad faith.

Interstate Commerce Law: Explains the constitutional basis of the law. The power of Congress to regulate foreign and domestic commerce. State control and taxation of properties.

REAL ESTATE LAW

(Gives legal training necessary to Real Estate Agents, Property Owners, and Business Men generally)

SUBJECTS FOR STUDY

(See outline, page 126)

The subjects covered by the course in Real Estate Law include those which are necessary for an understanding of the legal side

REAL ESTATE LAW

Gives legal training necessary to Real Estate Agents, Property Owners, and Business Men generally

24 TEXTBOOKS

NOTE: For detailed description of this course, see page 125. For synopses of textbooks, see alphabetical list of subjects, page 199.

Subject	Subject
Contracts and Agency (Summary)	Guaranty and Suretyship
Partnership, Bills, and Notes (Summary)	*Damages
Real Property Part I	Wills and Administration of Estates Part I
Real Property Part II	Wills and Administration of Estates Part II
Real Property Part III	Conveyancing and Abstracts
Real Property Part IV	Insurance Law Part I
Title to Estates	Insurance Law Part II
Landlord and Tenant	Fire Insurance Law (Including Standard Policy) Part I
*Mining Law	Fire Insurance Law (Including Standard Policy) Part II
*Irrigation Law	Fire Insurance Law (Including Standard Policy) Part III
Mortgages, Chattel and Real Part I	
Mortgages, Chattel and Real Part II	
Liens	
Trusts and Duties of Trustees	

*Optional work

Textbooks and Tuition \$75.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

of real estate transactions, together with such part of fire insurance law as may profitably be studied by real estate agents, brokers, or owners. The order in which the subjects should be studied is shown by the outline on page 126. For detailed synopsis of any subject, see alphabetical list beginning on page 199.

Contracts and Agency: A summary of corresponding texts in the complete course. What constitutes a valid contract at law. How a contract is interpreted and enforced, and how the obligation is ended. How a man (the "principal") transacts business, or incurs liability, through another (his "agent"). The rights of those who deal with an agent against his principal; the mutual rights of agent and principal. How the relation is terminated. How to avoid losses due to "crooked" agents.

Partnership, Bills, and Notes: A summary of corresponding texts in the complete course. The conduct of business by partners. Their duties and responsibilities to each other, and to third persons. Compared with corporation organization. "Commercial paper" — promissory notes, bonds, checks, drafts, and other orders for money. The nature of the different forms of paper, and the different obligations created; when they may be transferred, and how discharged.

Real Property: The different kinds of rights in land; how created, transferred, and destroyed, by gift, sale, or will. The nature of future interests in land.

Titles: The nature of a man's rights in land, under different kinds of ownership. How these rights are created, transferred, and destroyed.

Landlord and Tenant: The various kinds of agreements between landlord and tenant as to use of property, and how the responsibility for repairs and injuries is determined. The nature of eviction; and the legal remedies for the collection of rent, and recovery of property removed from the premises by the tenant.

Mining Law: The intricate subject of acquiring rights to mine. The rules regarding the right to follow the lode or vein, location of placer claims, and obtaining patents for mineral lands.

Irrigation Law: The nature of water rights, both riparian and in stream and underground water. Claims for damages that arise for use of water for irrigation, and how they are adjusted. The fundamental law governing all irrigation and reclamation work.

Mortgages: How land or personal property may be pledged for the payment of money. How the mortgage is made and foreclosed or discharged. How and when mortgaged property can be transferred by the owner.

Liens: The rights of "bailees" of goods to hold them against the owner as security for payment of debts, and rights to attach chattels or land for the same purpose; as when a hotel holds baggage until the guest's bills are paid. How the law creates a lien; how the right comes to an end. Special liens, as mechanics' lien on land, etc.

Trusts and Trustees: The rights of different parties when one man controls property as guardian of child holding property, trustee managing an estate for the heirs, etc. How children, wards, and purchasers of property are protected against fraud, embezzlement, and bad faith.

Guaranty and Suretyship: The system whereby a man or a company agrees to make good to a third party any losses occasioned to him by another, as when a surety company "goes on the bond" of a bank clerk. Discusses the rights of all parties concerned in such agreements.

Damages: How the law compels men, by the payment of damages, to recompense those whom they have wronged. When excessive damages are allowed as punishment. When the rights to different kinds of damages arise, and how enforced.

Wills and Estates: Transferring property by bequest. How the will must be drawn to be valid. The rights of heirs; how the will is carried into effect. Results when the will is invalid.

Conveyancing and Abstracts: The preparation of a copy of the title deeds and records, called an abstract of title, to property. The exact language and form of different instruments or papers concerned with the transfer of land.

Insurance: The general principles of fire, casualty, and marine insurance, and the laws governing the business. The rights, duties, and liabilities of the company; how the amount of damage is determined; how claims for and against the company are collected.

Fire Insurance Law: The conduct of a fire insurance company; its rights, and its liabilities to policy holders. How funds must be invested. Different policies written by fire insurance companies. How losses are adjusted fairly, and fraudulent claims avoided.

ACCOUNTANCY AND BUSINESS ADMINISTRATION

**Prepares for C. P. A. Examinations, or for position as Manager
or Department Manager**

49 TEXTBOOKS

NOTE: For detailed description of this course, see page 133. For
synopses of textbooks, see alphabetical list of subjects, page 227.

Subject	Subject
Commercial Arithmetic Part I	Publishers' and Printers' Accounts
Commercial Arithmetic Part II	Accounting for Modern Corporations
Theory of Accounts Part I	Practical Accounting Problems
Theory of Accounts Part II	Accounting Practice and Procedure
Single Proprietor's and Partners' Accounts	Business English
Wholesale, Commission, and Storage Accounts	†Baker: Correct English
Corporation Accounts	Business Correspondence
Single Entry Bookkeeping—Compara- tive Statements	Commercial Law Part I
The Voucher System—Accounting Charts	Commercial Law Part II
Billing and Order Recording	Commercial Law Part III
Retailers' Accounts	Commercial Law Part IV
Department Store Accounts Part I	Commercial Law Part V
Department Store Accounts Part II	Auditing Part I
Contractors' Accounts	Auditing Part II
Bank Bookkeeping Part I	Auditing Part III
Bank Bookkeeping Part II	Administrative and Industrial Organization
Mechanical Bookkeeping	Purchasing and Stores Department
Trustees', Executors', and Stock Brokers' Accounts	Advertising and Sales Organization
Accounting for Clubs, Hotels, and Societies	The Credit Organization
Brewers' Accounts	The Shipping Department
Insurance Accounts Part I	Correspondence and Filing
Insurance Accounts Part II	Business Statistics
Real Estate Accounting	Records of Labor and Manufacturing Orders
	General Expense and Cost Summaries
	Machine Shop Management
	Cost Analysis Engineering

†Standard textbook

Textbooks and Tuition \$110.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

COMMERCIAL DEPARTMENT

(Opened to students in 1909)

The courses offered in this Department are planned to prepare the student to hold well paid positions in either the executive or the accounting branches of business. While the Manager and the Certified Public Accountant hold positions widely different in their nature, both must have at least a general knowledge of the duties peculiar to the position of the other.

Accountancy and Business Administration: This complete course is recommended for every business man who does not already possess a systematic knowledge of the branches that it covers. Too many men, particularly those just entering business, make the mistake of stopping their training too soon. They know how to keep one set of books, or handle the work of one department; but they know nothing of general accounting or executive work; and that lack of information regarding the higher positions continually holds them back, while the man who has looked ahead gets the advancement for which he has fitted himself.

Modern business, with its gigantic corporations, million-dollar deals, and world-wide scope, is enormously complex. In order that it may be properly controlled and directed, every move and phase of its huge activity must be accurately recorded. The complex bookkeeping and accounting thus made necessary require the services of highly skilled Accountants, Auditors, and Bookkeepers. A separate bookkeeping method must be devised for each particular business, so adjusted as to show, at any time, its exact condition; and regular studies of these books must be made from time to time to guard against error or dishonesty. And when the affairs of a business become involved, experts must be called in to go over the books and make complete reports — perhaps to the company itself, to a bank and other creditors, or to a receiver in bankruptcy. Men who have the training necessary to handle any of this work can earn good livings; they are specialists, and are paid accordingly.

This complete course in accountancy and administrative organization is planned to give such thorough training to the man who will be satisfied only when he has reached the top. It will give the inexperienced man a thorough training in commercial practice, or enable the man with business experience to systematize his knowledge, and master by study the branches in which he has had no experience. It will fit the student either to fill a high managerial position, or to pass the examinations for the degree of C. P. A. (Certified Public Accountant) in any State that offers this degree.

C. P. A. examinations are held by the following States:

Arkansas	Iowa	Nebraska	Tennessee
California	Kansas	New Jersey	Texas
Colorado	Louisiana	New York	Utah
Connecticut	Maine	North Carolina	Vermont
Delaware	Maryland	North Dakota	Virginia
Florida	Massachusetts	Ohio	Washington
Georgia	Michigan	Oregon	West Virginia
Hawaii	Minnesota	Pennsylvania	Wisconsin
Illinois	Missouri	Rhode Island	Wyoming
Indiana	Montana	South Carolina	

The applicant for a C. P. A. certificate is examined on his knowledge of accounting practice, auditing, and commercial law; many States also require of the applicant a general education equivalent to that of a four-year high school course; this work is covered by the College Preparatory course of the American School (see page 146). For particulars regarding state requirements, time and place of examinations, etc., the inquirer is advised to write to his Secretary of State, at the State Capital.

Most of the States which do not now offer the C. P. A. degree are expected to do so in a year or two in response to the public demand. Men who are practicing as Public Accountants at the time of the passage of such a law are sometimes given the degree, without examination, in recognition of their experience; but this degree has little value unless it has training behind it. The man whose State has not yet recognized accountancy as a profession will be wise to begin at once his preparation for a state examination which may soon be required of him.

Practical Bookkeeping and Accounting: This short course in specialized accounting practice for all lines of business is recom-

mended for the practical Bookkeeper who wishes to increase his chances of promotion by getting a working knowledge of all branches of accounting. It prepares for a position as Chief Accountant or Head Bookkeeper.

Shorthand, Typewriting, and Bookkeeping: This short course in stenography, bookkeeping, and general office practice is recommended for the young man or young woman desiring comprehensive training in the fundamentals of a business career. It prepares for a position as Stenographer, Bookkeeper, or Private Secretary.

ACCOUNTANCY AND BUSINESS ADMINISTRATION

(Prepares for C. P. A. Examinations, or for position as Manager or Department Manager)

SUBJECTS FOR STUDY

(See outline, page 130)

The subjects covered by the course in Accountancy and Business Administration fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 130. For detailed synopsis of any subject, see alphabetical list beginning on page 227.

Arithmetic: A review of the elementary mathematical principles used in business computations. Explanation of practical "short cuts" that make possible quick figuring.

Theory of Accounts: The theory and practice of bookkeeping, auditing, and accounting. Definition of terms used; methods of keeping books and handling cash and bills; the different kinds of accounts kept for a business, and how they change to meet the needs of different kinds of business; how to take trial balances and prepare reports.

Proprietors and Partners: How to handle the books of a simple concern. Bookkeeping for different kinds of retail business;

how to record costs, check up on departments, determine profit and loss, dispose of bad accounts, and prepare trial balances and statements.

Commission: The special bookkeeping and accounting problems arising in a wholesale business. How to keep accounts and determine commissions for the broker and commission merchant; how to calculate storage charges, and keep proper records.

Corporations: Explanation of the special bookkeeping necessary in keeping corporation accounts. How to change single proprietor and partnership accounts into corporation form when a business is incorporated; how to record stock sales and transfers. How a stock company is formed, chartered, and organized. How surplus and dividends are determined and recorded.

Single Entry Bookkeeping: Principles and practice of single entry bookkeeping; changing from single entry to double entry. How to check up and discover errors and discrepancies in single entry accounts.

Recording Systems: Loose-leaf and other special recording forms. How vouchers assist in eliminating errors and losses. Use of billing machines; how orders are recorded and treated in order to have the goods moved quickly and without error.

Accounting Systems. Retailers: How the records of auto-graphic and cash registers are transferred to the proper books. How a department store is organized, and the several departments are coordinated and controlled by proper accounts. Efficient delivery systems; successful handling of mail order business; auditing the voluminous records. **Contractors:** Organization of a contractor's business. Keeping track of costs, recording expense and progress "on the job" and in the office. How to run a material yard efficiently. Principles of profitable estimating. **Banks:** Operation of a bank, and duties of bank officers. Bookkeeping systems that discourage the "juggling" of accounts. Consideration of special bookkeeping problems connected with savings banks and safety deposit vaults. **Trustees and Brokers:** Preparing the detailed reports that trustees and executors must file in court. Compiling a statement of the financial condition of any

property or estate; with special attention to the variations arising from the constant changes of the stock market. **Clubs and Hotels:** How hotels and clubs keep track of expenses of the kitchen, restaurant, and bedroom floors. Special problems presented by the accounts of societies, fraternal organizations, and labor unions. **Brewers:** Organization of the business. Special accounting work made necessary by the revenue taxes imposed by the Government. **Insurance:** Special systems for the several branches of insurance. Compiling the immense statistical tables required in the business. Keeping track of policies, premiums, and payments; the investment of company funds, and the condition of the business. **Real Estate:** Accounting systems that enable the agent to know exactly the condition and value of the various properties he is handling. How to record loans and payments, and keep track of rentals. **Publishers:** How publishers record their sales. Records that keep the printing shop working efficiently. Maintenance of the elaborate cost systems necessary, and the special accounts required by the business. **Corporations:** How great corporations handle their affairs, checking up on subsidiary companies, keeping track of money invested, determining profits and dividends. **Practical Problems:** Application of the fundamental principles outlined to the many types of business accounts.

Business Correspondence: Review of elementary principles of English grammar. Practical instruction in the handling of general business correspondence, and in the construction and phrasing of special forms for use in answering inquiries, making collections, etc.

Commercial Law: A summary of those branches of the law which particularly concern the business man; such as the laws relating to contracts, agency, commercial paper, real property, etc. Designed to enable the business man to conduct his affairs so as to protect his rights, and avoid the trouble that often arises from ignorance of the law.

Auditing: Verifying the accounts of a big business; collecting, summarizing, and tabulating the results so as to give reliable information. Special consideration of the varying problems found in different kinds of business.

Departmental Organization. *Administrative:* How a modern business is organized and administered. *Stores:* How proper records enable the purchasing agent to know at all times the condition of his stock and the state of the market. *Sales:* Systems that check up results against costs for all kinds of advertising, showing what kinds are profitable. Devising and maintaining the many detailed records necessary to a successful mail order advertising campaign. Keeping track of salesmen and their results. *Credits:* Getting information concerning financial standing of customers; determining proper credit ratings. Collection systems that bring in money due quickly and with small losses. *Shipping:* How to fill orders promptly and correctly. How to handle retail deliveries efficiently. *Filing:* How to choose and maintain the filing system best suited to a particular business.

Statistics: Organization of statistical department for obtaining data and compiling reports. Methods of checking up on workmen, learning what they produce and earn under different wage systems, and determining the cost of each product. Establishing a basis of expense distribution, distinguishing between productive and nonproductive labor, and preparing cost summaries showing the exact condition of the business and all its departments.

Shop Management: Approved methods of accounting, recording, and systematizing, as applied to making more efficient the organization of modern industrial plants.

Cost Analysis: The science of determining and analyzing manufacturing costs, with particular attention to proved methods of reducing costs.

PRACTICAL BOOKKEEPING AND ACCOUNTING

(Prepares for position as Chief Accountant or Head Bookkeeper)

SUBJECTS FOR STUDY

(See outline, page 137)

The subjects covered by the course in Practical Bookkeeping and Accounting fall generally under the main heads elaborated below. The relative importance of these subjects, and the order

PRACTICAL BOOKKEEPING AND ACCOUNTING

Prepares for position as Chief Accountant or Head Bookkeeper

30 TEXTBOOKS

NOTE: For detailed description of this course, see page 136. For synopses of textbooks, see alphabetical list of subjects, page 227.

Subject	Subject
Commercial Arithmetic Part I	Bank Bookkeeping Part I
Commercial Arithmetic Part II	Bank Bookkeeping Part II
Theory of Accounts Part I	Mechanical Bookkeeping
Theory of Accounts Part II	Trustees', -Executors', and Stock Brokers' Accounts
Single Proprietor's and Partners' Accounts	Accounting for Clubs, Hotels, and Societies
Wholesale, Commission, and Storage Accounts	Brewers' Accounts
Corporation Accounts	Insurance Accounts Part I
Single Entry Bookkeeping—Comparative Statements	Insurance Accounts Part II
The Voucher System—Accounting Charts	Real Estate Accounting
Billing and Order Recording	Publishers' and Printers' Accounts
Retailers' Accounts	Accounting for Modern Corporations
Department Store Accounts Part I	Practical Accounting Problems
Department Store Accounts Part II	Accounting Practice and Procedure
Contractors' Accounts	Business English
	†Baker: Correct English
	Business Correspondence

†Standard textbook

Textbooks and Tuition \$70.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

in which they should be studied, are shown by the outline on page 137. For detailed synopsis of any subject, see alphabetical list beginning on page 227.

Arithmetic: A review of the elementary mathematical principles used in business computations. Explanation of practical "short cuts" that make possible quick figuring.

Theory of Accounts: The theory and practice of bookkeeping, auditing, and accounting. Definition of terms used; methods of keeping books and handling cash and bills; the different kinds of accounts kept for a business, and how they change to meet the needs of different kinds of business; how to take trial balances and prepare reports.

Proprietors and Partners: How to handle the books of a simple concern. Bookkeeping for different kinds of retail business; how to record costs, check up on departments, determine profit and loss, dispose of bad accounts, and prepare trial balances and statements.

Commission: The special bookkeeping and accounting problems arising in a wholesale business. How to keep accounts and determine commissions for the broker and commission merchant; how to calculate storage charges, and keep proper records.

Corporations: Explanation of the special bookkeeping necessary in keeping corporation accounts. How to change single proprietor and partnership accounts into corporation form when a business is incorporated; how to record stock sales and transfers. How a stock company is formed, chartered, and organized. How surplus and dividends are determined and recorded.

Single Entry Bookkeeping: Principles and practice of single entry bookkeeping; changing from single entry to double entry. How to check up and discover errors and discrepancies in single entry accounts.

Recording Systems: Loose-leaf and other special recording forms. How vouchers assist in eliminating errors and losses. Use of billing machines; how orders are recorded and treated in order to have the goods moved quickly and without error.

Accounting Systems. *Retailers:* How the records of autographic and cash registers are transferred to the proper books. How a department store is organized, and the several departments are coordinated and controlled by proper accounts. Efficient delivery systems; successful handling of mail order business; auditing the voluminous records. *Contractors:* Organization of a contractor's business. Keeping track of costs, recording expense and progress "on the job" and in the office. How to run a material yard efficiently. Principles of profitable estimating. *Banks:* Operation of a bank, and duties of bank officers. Bookkeeping systems that discourage the "juggling" of accounts. Consideration of special bookkeeping problems connected with savings banks and safety deposit vaults. *Trustees and Brokers:* Preparing the detailed reports that trustees and executors must file in court. Compiling a statement of the financial condition of any property or estate; with special attention to the variations arising from the constant changes of the stock market. *Clubs and Hotels:* How hotels and clubs keep track of expenses of the kitchen, restaurant, and bedroom floors. Special problems presented by the accounts of societies, fraternal organizations, and labor unions. *Brewers:* Organization of the business. Special accounting work made necessary by the revenue taxes imposed by the government. *Insurance:* Special systems for the several branches of insurance. Compiling the immense statistical tables required in the business. Keeping track of policies, premiums, and payments; the investment of company funds, and the condition of the business. *Real Estate:* Accounting systems that enable the agent to know exactly the condition and value of the various properties he is handling. How to record loans and payments, and keep track of rentals. *Publishers:* How publishers record their sales. Records that keep the printing shop working efficiently. Maintenance of the elaborate cost system necessary and the special accounts required by the business. *Corporations:* How great corporations handle their affairs, checking up on subsidiary companies, keeping track of money invested, determining profits and dividends. *Practical Problems:* Application of the fundamental principles outlined to the many types of business accounts.

Business Correspondence: Review of elementary principles of English grammar. Practical instruction in the handling of general

business correspondence, and in the construction and phrasing of special forms for use in answering inquiries, making collections, etc.

SHORTHAND, TYPEWRITING, AND BOOKKEEPING

(Prepares for position as Stenographer, Bookkeeper, or Private Secretary)

SUBJECTS FOR STUDY

(See outline, page 141)

The subjects covered by the course in Shorthand, Typewriting, and Bookkeeping fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 141. For detailed synopsis of any subject, see alphabetical list beginning on page 227.

Shorthand: Instruction and practice in a modern system of stenography that insures rapidity and accuracy in taking and reading notes.

Typewriting: Operation of any standard type of machine, taught by the rapid "touch system."

Arithmetic: A review of the elementary mathematical principles used in business computations. Explanation of practical "short cuts" that make possible quick figuring.

Theory of Accounts: The theory and practice of bookkeeping, auditing, and accounting. Definition of terms used; methods of keeping books and handling cash and bills; the different kinds of accounts kept for a business, and how they change to meet the needs of different kinds of business; how to take trial balances and prepare reports.

Proprietors and Partners: How to handle the books of a simple concern. Bookkeeping for different kinds of retail business; how to record costs, check up on departments, determine profit and loss, dispose of bad accounts, and prepare trial balances and statements.

SHORTHAND, TYPEWRITING, AND BOOKKEEPING

Prepares for position as Stenographer, Bookkeeper, or Private Secretary

18 TEXTBOOKS

NOTE: For detailed description of this course, see page 140. For synopses of textbooks, see alphabetical list of subjects, page 227.

Subject	Subject
American Shorthand System Part I	Corporation Accounts
American Shorthand System Part II	Single Entry Bookkeeping—Comparative Statements
American Shorthand System Part III	The Voucher System—Accounting Charts
†Pickert: Touch Typewriting	Billing and Order Recording
Commercial Arithmetic Part I	Correspondence and Filing
Commercial Arithmetic Part II	Business English
Theory of Accounts Part I	†Baker: Correct English
Theory of Accounts Part II	Business Correspondence
Single Proprietor's and Partners' Accounts	
Wholesale, Commission, and Storage Accounts	

†Standard textbook

Textbooks and Tuition \$45.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

Commission: The special bookkeeping and accounting problems arising in a wholesale business. How to keep accounts and determine commissions for the broker and commission merchant; how to calculate storage charges, and keep proper records.

Corporations: Explanation of the special bookkeeping necessary in keeping corporation accounts. How to change single proprietor and partnership accounts into corporation form when a business is incorporated; how to record stock sales and transfers. How a stock company is formed, chartered, and organized. How surplus and dividends are determined and recorded.

Single Entry Bookkeeping: Principles and practice of single entry bookkeeping; changing from single entry to double entry.

How to check up and discover errors and discrepancies in single entry accounts.

Recording Systems: Loose-leaf and other special recording forms. How vouchers assist in eliminating errors and losses. Use of billing machines; how orders are recorded and treated in order to have the goods moved quickly and without error.

Business Correspondence: Review of elementary principles of English grammar. Practical instruction in the handling of general business correspondence, and in the construction and phrasing of special forms for use in answering inquiries, making collections, etc.

COLLEGE PREPARATORY DEPARTMENT

(Opened to students in 1903)

The courses offered in this Department are planned to prepare the student to meet the entrance requirements of any American college or engineering school, or to give him the general education afforded by a four-year high school course.

College Preparatory: This complete course is recommended for every man who has not had a high school education. It is based upon the entrance requirements of the College Entrance Examination Board, and includes the subjects usually offered in the preparatory courses of high and preparatory schools. The work offered is of the standard of that given in the same subjects by the average high school.

The four-year course of the average public high school is planned either to prepare the student for entering college; or, if he cannot go to college, to give him a good general education. In either case, his high school education is meant to be only a foundation, upon which he can build later as the need arises. To the man who goes to college, this fact is very clear, because he is admitted to college only after giving proof that he has mastered the high school work. But the young man who has no expectation of going to college often feels that that fact makes it a waste of time for him to finish high school. He does not understand the meaning or value of a general education; and he is later surprised and disheartened when he finds how much importance is placed upon the possession of a high school diploma.

As a matter of fact, this insistence is based upon sound experience, for it has been learned that a man who has not had at least a high school training is not mentally prepared to undertake either the study or the practice of many professions and many branches of business. The young man who desires to study law or medicine, or take the state examination for the degree of Certified Public Accountant, is required in a majority of States to

prove that he has received a high school education, or its equivalent; and the applicant for a position in many branches of business is met with the same demand. This course gives the full equivalent of a four-year high school course, both in the subjects covered, and in the quality of work required of the student.

The student who contemplates taking this course in preparation for college entrance examinations should give careful consideration both to the optional subjects offered, and to the "unit" system of reckoning the value of the work offered in each subject. By referring to the table of entrance requirements by units furnished by his own college, the prospective student can readily determine how nearly the work offered meets his needs, and what changes in order or subjects he will require; he can have these changes made, without extra charge, by notifying the School of his requirements.

In general, this course as outlined is flexible enough to prepare the student to pass the entrance examinations to a course leading to the Ph. B. or S. B. degree; or to enable him to make up deficiencies in language, history, and the sciences. The English classics required for reading and study are those selected by the College Entrance Examination Board; the student is given laboratory practice in both physics and chemistry (see page 29); he is given the elementary work in French and German, and is allowed to select from the science offered the number of units required by the college that he has chosen. The American School guarantees that the student will pass the entrance requirements of any college or technical school, in subjects in which he does satisfactory work.

Engineering Preparatory: This complete course is recommended for every man who is preparing to enter a technical school, or who desires the general education of which it is the equivalent. The course covers the same general subjects as those offered in the College Preparatory Course; but it puts less emphasis upon the languages and more upon the sciences, and adds instruction in mechanical drawing. It offers a general training in mathematics, language, history, and science that will enable the student to make up such deficiencies in his education. The American School guarantees that the student will pass the entrance requirements of any college or technical school, in all subjects in which he does satisfactory work.

COLLEGE PREPARATORY

(Prepares for Entrance to College Course leading to Ph. B. or
S. B. Degree, or gives the Equivalent of a
Four-Year High School Course)

SUBJECTS FOR STUDY

(See outline, page 146)

The subjects covered by the College Preparatory Course fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 146. For detailed synopsis of any subject, see alphabetical list beginning on page 241.

Elementary Mathematics: A review of Arithmetic and the elements of Algebra; useful both in "brushing up" on work done in the grade schools, and in preparation for the study of Advanced Mathematics. No college entrance credit, as this is grade school work.

Latin: Equivalent of two years' work in the grammar and literature of the Latin language, based on a study of the most interesting parts of Caesar's Commentaries. Provides a sound basis for college work in Latin. Two units credit for college entrance.

History: The history of man's progress from his original savage state, down through the glorious age of Grecian culture, and the rise and fall of the Roman power. The history of the United States of America from the discovery and settlement of the American continent to the presidency of Theodore Roosevelt; with particular attention to the events and racial traits through which the United States has evolved from a loose federation of jealous colonies to a united and respected world power. Two units credit for college entrance.

Advanced Mathematics: A simple but thorough course in Algebra and Plane Geometry, such as is necessary for admission to college work in Mathematics or the Sciences. Two units credit for college entrance.

English: A careful study of the grammar and rhetoric of the English language, with ample practice in English composition,

COLLEGE PREPARATORY

Prepares for entrance to College Course leading to Ph. B. or S. B. Degree, or gives the Equivalent of a Four-Year High School Course

73 TEXTBOOKS

NOTE: For detailed description of this course, see page 145. For synopses of textbooks, see alphabetical list of subjects, page 241.

Subject
PRACTICAL MATHEMATICS
 Practical Mathematics Parts I-IV
LATIN (2 units)
 First Year Latin
 †Collar & Daniel: First Year Latin
 †Bennett: Latin Grammar
 Second Year Latin
 †Allen & Greenough: Caesar
ANCIENT HISTORY (1 unit)
 Ancient History
 †Morey: Outlines of Greek History
 †Morey: Outlines of Roman History
ALGEBRA (1 unit)
 Algebra Parts I-II
GEOMETRY (1 unit)
 Plane Geometry
ENGLISH (3 units)
 English Grammar and Rhetoric
 Parts I-II
 English Classics Parts I-III
 †Addison: The Sir Roger de Coverley Papers
 †Burke: Speech on Conciliation with America
 †Carlyle: Essay on Burns
 †Coleridge: Rime of the Ancient Mariner
 †Eliot: Silas Marner
 †Goldsmith: Vicar of Wakefield; The Deserted Village
 †Irving: Sketch Book
 †Lamb: Essays of Elia
 †Macaulay: Life of Johnson
 †Milton: Lycidas, Comus, L'Allegro, Il Penseroso
 †Scott: Ivanhoe; Lady of the Lake
 †Shakespeare: Julius Caesar; Macbeth; The Merchant of Venice

Subject
 †Tennyson: Gareth and Lynette; Lancelot and Elaine; The Passing of Arthur
 †Washington: Farewell Address
 †Webster: Bunker Hill Oration
GERMAN (1 unit)
 German
 †Bierwirth: Beginning German, Grammar
 †Schrakamp & Van Daell: Das Deutsche Buch, Reader
 †Schrakamp: Exercises in Conversational German, Reader
FRENCH (1 unit)
 French
 †Fraser & Squair: French Grammar
UNITED STATES HISTORY (1 unit)
 United States History
 †McMaster: History of the United States
CIVICS (½ unit)
 Civics
 †Forman: Advanced Civics
SCIENCE (2 units) chosen from:
Chemistry (1 unit)
 Elements of Chemistry
 General Chemistry Parts I-VII
 †Remsen: College Chemistry
Physics (1 unit)
 Physics Parts I-IV
 †Millikan & Gale: First Course in Physics
 †Millikan & Gale: Laboratory Manual
Botany (½ unit)
 Elementary Botany Parts I-II
 †Bergen & Caldwell: Practical Botany
Astronomy (½ unit)
 Astronomy Parts I-IV

†Standard textbooks. The list of English classics will be changed and the course of instruction altered to meet different college entrance requirements without extra cost to the student.

Textbooks and Tuition \$150.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

and particular attention to the correct and effective use of the "mother tongue" in speech and writing. A reading course covering the selections from the English Classics required for college entrance, designed to enable the student to understand and enjoy the best works of the best writers of English. Three units credit for college entrance.

German: The equivalent of one year's instruction in reading and writing the German language, planned particularly to give thorough preparation for college work in German. One unit credit for college entrance.

French: The equivalent of one year's instruction in reading and writing the French language, planned particularly to give thorough preparation for college work in French. One unit credit for college entrance.

Civics: A study of the principles, organization, and functions of the American Government. The equivalent of college work in the same subject. One-half unit credit for college entrance.

Chemistry: Training in the fundamentals of inorganic Chemistry, giving the necessary preparation for college work in Chemistry, or in other Sciences requiring a knowledge of chemical principles. It includes the performance of 144 laboratory experiments with actual chemicals and apparatus furnished for the purpose. One unit credit for college entrance.

Physics: Training in the fundamentals of Physics, giving the necessary preparation for college work in Physics, or in other Sciences requiring a knowledge of physical principles. It includes the performance of fifty laboratory experiments with apparatus furnished for the purpose. One unit credit for college entrance.

Botany: Instruction in the elements of Botany, as studied from actual plant forms with the aid of only a hand magnifier. Preparation for college work in Botany or Biology. One-half unit credit for college entrance.

Astronomy: A general study of Astronomy, without the use of instruments. It includes the formation of the universe, the relation of the world to the rest of the solar system and the universe,

ENGINEERING PREPARATORY

Prepares for entrance to Engineering Schools and Colleges

80 TEXTBOOKS

NOTE: For detailed description of this course, see page 149. For synopses of textbooks, see alphabetical list of subjects, page 241.

Subject

PRACTICAL MATHEMATICS
Practical Mathematics Parts I-IV
MECHANICAL DRAWING (2 units)
Mechanical Drawing Parts I-III
Machine Drawing Parts I, II, III A, III B
ALGEBRA (1½ units)
Algebra Parts I-IV
GEOMETRY (1½ units)
Plane Geometry (1 unit)
Solid Geometry (½ unit)
TRIGONOMETRY (½ unit)
Logarithmic Tables
Trigonometry Parts I-II
*Graphs
ENGLISH (3 units)
English Grammar and Rhetoric
Parts I-II
English Classics Parts I-III
†Addison: The Sir Roger de Coverley Papers
†Burke: Speech on Conciliation with America
†Carlyle: Essay on Burns
†Coleridge: Rime of the Ancient Mariner
†Eliot: Silas Marner
†Goldsmith: Vicar of Wakefield; The Deserted Village
†Irving: Sketch Book
†Lamb: Essays of Elia
†Macaulay: Life of Johnson
†Milton: Lycidas, Comus, L'Allegro, Il Penseroso
†Scott: Ivanhoe; Lady of the Lake
†Shakespeare: Julius Cæsar; Macbeth; The Merchant of Venice

Subject

†Tennyson: Gareth and Lynette; Lancelot and Elaine; The Passing of Arthur
†Washington: Farewell Address
†Webster: Bunker Hill Oration
GERMAN OR FRENCH (1 unit)
German
†Bierwirth: Beginning German, Grammar
†Schrakamp & Van Daell: Das Deutsche Buch, Reader
†Schrakamp: Exercises in Conversational German, Reader
French
†Fraser & Squair: French Grammar
ANCIENT HISTORY (1 unit)
Ancient History
†Morey: Outlines of Greek History
†Morey: Outlines of Roman History
UNITED STATES HISTORY (1 unit)
United States History
†McMaster: History of the United States
SCIENCE (2 units) chosen from:
Chemistry (1 unit)
Elements of Chemistry
General Chemistry Parts I-VII
†Remsen: College Chemistry
Physics (1 unit)
Physics Parts I-VI
†Millikan & Gale: First Course in Physics
†Millikan & Gale: Laboratory Manual
Botany (½ unit)
Elementary Botany Parts I-II
†Bergen & Caldwell: Practical Botany
Astronomy (½ unit)
Astronomy Parts I-IV

*Optional work.

†Standard textbooks. The list of English classics will be changed and the course of instruction altered to meet different college entrance requirements without extra cost to the student.

Textbooks and Tuition \$165.00 Payable \$5.00 a Month

NOTE: See section on "Terms of Enrollment," page 29.

and the process of evolution by which worlds are made, grow old, and die. One-half unit credit for college entrance.

ENGINEERING PREPARATORY

(Prepares for Entrance to Engineering Schools and Colleges)

SUBJECTS FOR STUDY

(See outline, page 148)

The subjects covered by the Engineering Preparatory Course fall generally under the main heads elaborated below. The relative importance of these subjects, and the order in which they should be studied, are shown by the outline on page 148. For detailed synopsis of any subject, see alphabetical list beginning on page 241.

Elementary Mathematics: A review of Arithmetic and the elements of Algebra; useful both in "brushing up" on work done in the grade schools, and in preparation for the study of Advanced Mathematics as used in engineering work. No college entrance credit, as this is grade school work.

Drawing: Practice in mechanical drawing and lettering, with particular attention to projections. Principles and methods of designing engines and machines for special purposes, with particular regard to the factor of safety. Careful discussion of the types of gearing, pulleys, gears, etc., most efficient under given conditions. Two units credit for college entrance.

Advanced Mathematics: A thorough course in Algebra, Plane and Solid Geometry, and Trigonometry, such as is necessary for admission to college work in the engineering or scientific branches. Two units credit for college entrance.

English: A careful study of the grammar and rhetoric of the English language, with ample practice in English composition, and particular attention to the correct and effective use of the "mother tongue" in speech and writing. A reading course covering the selections from the English Classics required for college entrance, designed to enable the student to understand and enjoy the best

works of the best writers of English. Three units credit for college entrance.

Language: The equivalent of one year's instruction in reading and writing either the German or the French language, planned particularly to give thorough preparation for college work in the language selected. One unit credit for college entrance.

History: The history of man's progress from his original savage state, down through the glorious age of Grecian culture, and the rise and fall of the Roman power. The history of the United States of America from the discovery and settlement of the American continent to the presidency of Theodore Roosevelt; with particular attention to the events and racial traits through which the United States has evolved from a loose federation of jealous colonies to a united and respected world power. Two units credit for college entrance.

Chemistry: Training in the fundamentals of inorganic Chemistry, giving the necessary preparation for college work in Chemistry, or in other Sciences requiring a knowledge of chemical principles. It includes the performance of 144 laboratory experiments with actual chemicals and apparatus furnished for the purpose. One unit credit for college entrance.

Physics: Training in the fundamentals of Physics, giving the necessary preparation for college work in Physics, or in other Sciences requiring a knowledge of physical principles. It includes the performance of fifty laboratory experiments with apparatus furnished for the purpose. One unit credit for college entrance.

Botany: Instruction in the elements of Botany, as studied from actual plant forms with the aid of only a hand magnifier. Preparation for college work in Botany or Biology. One-half unit credit for college entrance.

Astronomy: A general study of Astronomy, without the use of instruments. It includes the formation of the universe, the relation of the world to the rest of the solar system and the universe, and the process of evolution by which worlds are made, grow cold, and die. One-half unit credit for college entrance.

**SYNOPSIS
OF SUBJECTS**

The Student's Creed

I WILL blot out of my life the failures that come from wasted hours, and write into it the successes that come from time well spent.

I will keep life's page clean, and fill it with the record of knowledge gained.

I will fix my eyes on the goal of my ambition, and hold my hand to its task.

I will work hard, hope high, and live up to the best that is in me; then I can write at the end, "Well done!"

SYNOPSIS OF SUBJECTS IN ENGINEERING DEPARTMENTS

(Arranged Alphabetically)

AIR BRAKES—Prepared by LLEWELLYN V. LUDY, M. E., Professor, Experimental Engineering, Purdue University

Part I

WESTINGHOUSE STEAM RAILROAD AIR BRAKE SYSTEM: Air Compressors: Single-Stage Type, Two-Stage Type, Troubles, Compressor Governors, Main Reservoir—Valves and Valve Appliances: Automatic Brake Valves (G-6 Type, H-6 Type, S-6 Independent Type, Duplex Air Gage), Feed Valves (C-6 Single-Pressure Type, B-6 Double-Pressure Type), Triple Valves (Plain Type, Quick-Action Type, K Freight Type, L Type), Pressure Retaining Valves, Conductor's Valve, High-Speed Reducing Valve, E-6 Safety Valve

Part II

FUNDAMENTAL BRAKE TYPES: High-Speed Brake Equipment—Double-Pressure Control or Schedule U—LN Passenger-Car Brake Equipment

ET-6 LOCOMOTIVE BRAKE EQUIPMENT: Functions and Advantages—Manipulation of Equipment—Distributing Valve and Double-Chamber Reservoir: Automatic Brake Operation, Independent Brake Operation

PC PASSENGER BRAKE EQUIPMENT: Special Features—Control Valve: Release and Charging Position, Service Application, Releasing Action, Emergency Position—Instructions for Operating PC Equipment—Improvements in Brake Equipment—Westinghouse Train Air-Signal System: Instruction for Care of Equipment

AIR-BRAKE EQUIPMENT FOR ELECTRIC CARS: Hand Brakes—Early Air-Brake Forms—SME Brake Equipment: Working Parts, Equipment on Non-Motor Trailers, Operation Rules, Graphical Representation of Proper Braking Methods, Type D-EG Motor-Driven Air Compressor, Type J Electric Compressor Governor, Type M-18 Brake Valve, Duplex Air Gage, Type D Emergency Valve, Brake Cylinder

ALGEBRA—Prepared by WALTER J. RISLEY, B. S., M. A., Professor of Mathematics, James Milliken University

Part I

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BINOMIAL THEOREM: Positive Integral Exponents—Binomial Formula—Binomial Theorem for Negative or Fractional Exponents—Miscellaneous Problems

ALTERNATING CURRENT MACHINERY—Prepared by WILLIAM ESTY, S. B., M. A., Head of Department of Electrical Engineering, Lehigh University

Part I—FUNDAMENTAL PRINCIPLES

ALTERNATING E. M. F'S AND CURRENT: Simple Alternator—Frequency—Advantages and Disadvantages—Laws—Graphical Representation of E. M. F. and Current—Inductance—Capacity—Resistance—Reactance—Impedance—Resonance—Losses in Transmission Lines

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COMMERCIAL TYPES: Revolving Armature Type—Revolving Field Type—Turbo-Alternators—Water-Wheel-Driven Alternators

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ROTARY CONVERTERS: Comparisons with D. C. Dynamo—E. M. F. and Current Relations—Uses—Hunting—Inverted Rotaries—Excitation—Systems—Testing

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SWITCHBOARD AND STATION APPLIANCES: Switchboard Wiring and Connections—Feeder Panels—Synchronizers—Circuit Breakers—Regulators—Compensators—Lightning Arresters—Appendix

APPLIED ELECTROCHEMISTRY—Prepared by CHARLES F. BURGESS, E. E., Formerly Professor of Chemical Engineering and Applied Electrochemistry, University of Wisconsin, American Chemical Society. President, Northern Chemical Engineering Laboratories

INTRODUCTION: Historical: Faraday, Volta, Galvani—Relation of Early Work to Telephone and Telegraph—Electroplating—Impetus Due to Dynamo Electric Machinery and Cheap Power—Siemen's Electric Furnace—Basis of Modern Electric Furnace Industry

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ELECTROLYTIC APPLICATIONS: Refining of Metals—Recovery of Metals—Electroplating—Decomposition of Salt for Bleach and Caustic—Decomposition of Water into Oxygen and Hydrogen—Electrolytic Manufacture of Aluminum—Electrolytic Manufacture of Sodium

ELECTRIC FURNACE WORK: Economy of Electric Furnace—Manufacture of Calcium Carbide—Manufacture of Carborundum—Manufacture of Graphite—Metallurgy of Iron and Steel—Work with Other Metals—Fixation of Atmospheric Nitrogen and Manufacture of Fertilizer

HIGH TENSION WORK: Methods of Obtaining Ozone from the Atmosphere—Settlement of Dust and Fume

ARCHITECTURAL DRAWING—Prepared by FRANK A. BOURNE, S. M., and H. V. von HOLST, A. B., S. B., Architects

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WASH AND WATER COLOR: Line Drawing—Definitions—Importance of Axes—Modeling—Rendering in Wash—Materials—Method of Procedure—Rendering Elevations, Sections, and Plans—Color Hints—Water Color Rendering—Water Color Sketching—Preliminary Studies in Architectural Design—Method of Study—Putting Ideas on Paper—Use of Tracing Paper—Sketching—Materials for Sketching—Measured Work—Measuring Tapes—Datum Lines—Hand Level—Elevation Measurements—Arches—Projections—Inaccessible Portions—Approximations—Rubbings

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ARCHITECTURAL LETTERING—Prepared by FRANK CHOUTEAU BROWN, Architect

STYLES: Letters for Titles—Various Alphabets—Skeleton Letters—Composition and Spacing—Title Page—Plans—Working Drawings—Inscription Lettering—Lettering for Stone—Shadow—Cast Letters—Raised Letters—Examples of Lettering—Gothic—Roman

AUTOMOBILE DRIVING—Prepared by MORRIS A. HALL, B. S., Formerly Managing Editor, "Motor Life"

STARTING AND STOPPING CAR: Closing Throttle—Emergency and Service Brakes—Engine as Brake—Cranking—Mechanical, Gas and Air, and Electric Starters

CONTROL: Selectors—Gear Changing—Reversing—Left Control—Steering Gear—Clutch—Chains

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ROAD REGULATIONS: Passing Vehicles—Road Crossings—Blind Turn—Left-Hand Drive—City Driving—Blue Books—Road Guides

TROUBLES: Grinding Valves—Carbon Deposits—Lubricants—Carburetor Troubles—Ignition Troubles—Measuring Instruments—Springs—Demountable Rims—Detachable Wheels

TOURING INFORMATION: Requirements in United States and Canada—Touring Books—Maps—Foreign Licenses—Shipping—American Customs Arrangements

BACTERIOLOGY AND SANITATION—Prepared by GLENN M. HOBBS, Ph. D., Secretary, and Educational Director, American School of Correspondence

BACTERIOLOGY: Early History—Compound Microscope—Fermentation a Disease—Pasteur and the Silkworm Disease—Liquid Cultures—Robert Koch—Antiseptic Surgery—Koch and "Solid" Cultures—Classification of Bacteria—Useful Bacteria—Nitrifying Bacteria—Other Useful Forms—Toxines—Vital Resistance and Susceptibility—Immunity—Artificial Immunity—Vaccination—Antitoxines

SANITATION: The Role of Personal Hygiene—Public Hygiene—Medium of Infection and Contagion—The Alimentary Canal—Sources of Infection—Carriers of Disease—The Soil—The Atmosphere—Personal Cleanliness—Sewage a Carrier of Disease—Disposal by Running Streams—Running Water and Still Water—Intermittent Filtration—Water an Agent in Spread of Disease—Typhoid Fever—Danger of Infection from Milk Supply—Pasteurization—Sterilization

BOILER ACCESSORIES—Revised by R. H. KUSS, M. E., Sales Manager, Edge Moor Iron Co., Chicago

BOILER ATTACHMENTS: Manholes and Handholes—Supports—Bracket Types, Suspension Types—Fusible Plugs—Steam Gages—Water Columns—Valves: Manually Operated (Globe, Angle, Gate, Check Valves), Automatically Operated (Safety, Blow-off, Reducing)—Steam Piping

WATER END AUXILIARIES: Feed Water Control—Pumps: Reciprocating Types, Injectors, Centrifugal Type—Regulating and Heating Feed Water: Evaporators, Heaters, Skimmers, Strainers

STEAM END AUXILIARIES: Superheaters—Steam Separators—Steam Traps

BOILER PRACTICE—Revised by R. H. KUSS, M. E., Sales Manager, Edge Moor Iron Co., Chicago

HEAT GENERATION: Boiler Settings—Supporting Structures—Hand-Fired Furnaces—Area of Grates—Firing by Hand—Special Hand-Fired Furnaces—Oil-Burning Furnaces—Mechanical Stokers

BOILER MANAGEMENT: External and Internal Corrosion—Incrustation—Lagging—Boiler Explosion—Boiler Inspection—Smoke Prevention—Fuels and Fuel Economy—Natural and Forced Drafts—Chimneys—Systems of Mechanical Drafts—Fuel Economizers—Boiler Efficiency—Boiler Trials—Methods of Making Test—Abstract A. S. M. E. Boiler Test Code

BRIDGE ENGINEERING—Prepared by FRANK O. DUFOUR, C. E., Formerly Assistant Professor of Structural Engineering, University of Illinois

Part I

STRESS ANALYSIS: Trussed Bridge Development—Definitions—Classes of Trusses—Weights of Bridges—Cooper's Loading Diagram—Method of Moments—Notation—Warren Truss under Dead Loads—Position of Live Load for Maximum Moments—Position of Live Load for Maximum Positive and Negative Shears—Warren Truss under Live Loads—Counters—Maximum and Minimum Stresses—Trusses under Dead and Live Loads—Use of Engine Loads—Position of Wheel Loads for Maximum Shear—Position of Wheel Loads for Maximum Moments—Impact Stresses—Wind-Load Effects—Portals and Sway Bracing—Moments in Plate-Girders—Computation of Dead-Load and Live-Load Moments—Reactions for a Deck Plate-Girder—Maximum Moments in a Deck Plate-Girder—Shears in Plate-Girders—Wheel Positions for Maximum Shears

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BRIDGE DESIGN: Width of Plate-Girder Bridges for Various Spans—Clearance Diagram—Weights and Loadings—Specifications—Stress Sheet—Floor System—Practical Considerations—Design of a Plate-Girder Railway Span—Masonry Plan—Determination of the Span—Table of Pins for Bridges—The Portal—Transverse Bracing—Lateral Systems—Shoe and Roller Nests

APPENDIX: Tables for Designing Deck Plate-Girders—Tables of Cost Data

BUILDING CODE—Prepared by F. W. FITZPATRICK, Consulting Architect (formerly of U. S. Service)

ORDINARY CONSTRUCTION: Organization, Administration, and Supervision of Building Department—Plans—Fees—Penalties—Appeals and License—Fire Limits—Quality of Materials—Tests—Factors of Safety—Calculation of Stresses—Loading of Soil—Excavations—Foundations and Footings—Walls, Piers, and Partitions—Boilers, Ovens, and Heating Apparatus—Stove and Smoke Pipes—Chimneys, Flues, and Fireplaces—Mill Construction

FIREPROOF CONSTRUCTION: General Specifications—Reinforced Concrete Construction—Reinforced Terra Cotta Hollow Tile—Concrete Building Blocks—Terra Cotta Building Blocks—Steel and Wrought Iron Construction

SPECIAL BUILDING REQUIREMENTS: Public Buildings, Theaters, Hotels, etc.—Plumbing, Heating, and Lighting—Hoistways—Elevators—Well-Holes—Stairways—Doors—Fire Appliances—Standpipes—Fire Extinguishers—Hooks—Axes—Automatic Sprinklers

BUILDING SUPERINTENDENCE—Parts I and II prepared by EDWARD NICHOLS, Architect; Part III prepared by EDGAR S. BELDEN, Engineer in Charge of George A. Fuller Construction Company, Kansas City, Missouri; Part IV prepared by CHESTER L. POST, with Condon Company, Chicago, Member American Society of Civil Engineers

Part I (Frame)

PRELIMINARY CONSIDERATIONS: Relations of Superintendent to Owner, Contractor, and Architect—Drawings—Rejection of Materials—Decisions—Supervision—Selection of Site

FRAME RESIDENCE: Description of House—Staking Out—Cellar Work and Foundations—Framing: Exterior, Roofs, Partitions—Mason Work—Outside Finish—Lathing and Plastering—Plumbing—Heating—Inside Finish—Painting—Final Inspection

Part II (Brick and Stone)

CITY BUILDING: Party Walls—Pile Foundations—Foundation Walls—Brick Work: Laying, Bonding, Arches—Lime and Cement—Cut Stonework: Testing, Finishing, Types of Masonry, Laying—Roofing: Tin, Slate, Tile, Composition—Gutters—Cornices—Bay Windows—Skylights—Framing—Flooring

Part III (Steel)

GENERAL REQUIREMENTS: Duties of Superintendent—Division of Work—Organization—Business Details—Legal Points Involved: Private Law, Contracts, Breach of Contract, Agents, Liability, Building Laws, Lien Laws—Handling Men—Ability to Interpret Detail Drawings

PRELIMINARY INSPECTION: Mill Inspection: Cast Iron, Wrought Iron, Steel Tests, Marking and Recording, Specifications—Shop Inspection: Drawings, Straightening, Marking, Punching, Riveting, Planing and Milling, Painting

ERECTING A STEEL STRUCTURE: Methods of Erection—Equipment: Derricks, Cableways, Authority over Equipment, Overloading, Tackle, Engines, Electric Hoists—Lines and Levels—Foundations: Bearing Capacity, Foundation Steel, Pile Foundations, Caissons—Superstructure: Sequence, Sorting Yard, Temporary Floors, Plumbing and Alignment, Floor Beams, Riveting, Concrete as Preservative, Paint—Contractors' Organization

Part IV (Concrete)

BELOW GROUND: Foundations: Spread, Piles, Caissons—Basement and Sub-Basement: Retaining Walls, Sewers, Plumbing Floors, Waterproofing

ABOVE GROUND: Track Structures—Types of Floor Construction: Types of Joists, Flat Slabs—Columns: Steel with Concrete Fireproofing, Hooped Columns, Reinforced Concrete—Concrete Materials—Forms—Reinforcing—Handling Concrete—Top Finish—Electric Conduits—Sprinkler System—Heating Pipes—Spandrels—Sash—Stairways—Roofing—Crane Ways—Elevators—Chimneys—Exterior Finish—Concreting in Cold Weather—Floor Tests

CARPENTRY—Prepared by GILBERT TOWNSEND, S. B., with Ross & Macdonald, Montreal

Part I

TIMBER: Classes of Trees—Growth—Wood Structure—Defects—Varieties—Conversion of Timber into Lumber—Characteristics

CARPENTER'S TOOLS: Steel Square—Saws—Planes—Screws—Nails

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ROOF AND ITS LAYOUT: Styles of Roofs—Roof Frame—Ridge—Common Rafters—Valley and Hip Rafters—Jack and Curved Rafters—Attic Partitions

SPECIAL FRAMING: Battered Frames—Truss Partitions—Inclined and Bowled Floors—Heavy Beams and Girders—Balconies and Galleries

TIMBER TRUSSES: King Post Truss—Queen Post Truss—Finck and Open Trusses—Truss Details

TOWERS AND STEEPLES: Styles and Methods of Construction—Details—Joints and Cross Bracing

VAULTS AND GROINS: Layout and Construction

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OUTSIDE WALL FINISH: Building Paper — Wood Table — Clapboards—Siding—Belt Courses

OUTSIDE ROOF FINISH: Finish at Eaves—Box Cornice—Gutters—Skylight Openings—Dormer Windows—Gambrel Roof Finish—Gable Finish—Verge Boards

WINDOW AND DOOR FINISH: Outside Finish — Pulley — Sill — Double Hung Sash—Upper and Lower Sash—Muntins—Mullions—Inside Door Frames—Doors

TRIMMING: Base of Skirting—Wainscoting—Wood Cornices — Wood Ceiling Beams—Stair-Case Finish

CHEMISTRY OF COMBUSTION—Prepared by A. H. NUCKOLLS, B. A., Chemical Engineer, Underwriters' Laboratories, Inc.

INTRODUCTORY CHEMISTRY: Nature of Matter—Molecules—Atoms—Elements—Compounds and Mixtures—Chemical Action—Chemical Affinity—Chemical Symbols—More Important Chemical Laws—Acids—Bases—Salts—General Properties of Gases and Solutions — More Important Compounds of Oxygen, Nitrogen, Carbon, Silicon, Iron, Sodium, and Potassium—Nomenclature—Classification

CHEMISTRY OF COMBUSTION: Temperature—Oxidation—Combustion—Heat of Combustion—Calorific Intensity—Flames — Incandescence — Ignition Point—Burning Point—Flashing Point—Fire Test—Spontaneous Ignition—Products of Combustion—Various Combustible Substances—Explosives—Fulminates and Detonators—Gas Air Mixtures—Vapor Air Mixtures—Explosive Range of Gases and Vapors—Dust Explosions—Oxygen Carrier

CIVIL ENGINEERING SPECIFICATIONS AND CONTRACTS—Prepared by RICHARD I. D. ASHBRIDGE, Civil Engineer

Part I

GENERAL INSTRUCTIONS: Engineering—Contract—Drawings—Specifications—Materials Employed—Extra Work—Dividing Line Between Contracts—Verbal Information—Mistakes

GENERAL PROVISIONS: General Drawings—Record Drawings—Notes upon Drawings—Verbal Agreements—Lines and Grades by Engineer—Measurements—Duties of Contractors—Materials—Time—Prices—Inspection—Builders' Insurance—Sanitary Regulations—Liability of Contractor—Damages—Alterations—Payment—Release of Liens—Agreement—Bond

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RAILROAD GRADING: Location of Work—Clearing — Excavation—Culverts—Ditches—Measurements—Foundations—Masonry—Cement — Concrete—Lumber—Steel—Wrought Iron—Cast Iron—Paving—Terra-Cotta Pipe Culverts—Cast-Iron Pipe Culverts

SPECIFICATIONS: Steel Bridges—Tunnels — Pile Trestle — Elevated Tanks and Stand Pipes—Stone Road—Track Laying—Ballasting and Surfacing—Cross-Ties—Overhead Construction of Electric Railway—Pavements and Curbing

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PROPOSALS: Notice to Bidders—Instructions to Bidders — Guaranty—Advertisements—Practice in Specification and Contract Writing

COMMERCIAL VEHICLES—Prepared by CHARLES B. HAYWARD, Consulting Engineer

Part I

GENERAL SURVEY: Design—Requirements—Classification—Motive Power

ELECTRIC VEHICLES: Advantages — Power Efficiency — Delivery Wagons: Design, Motor Suspension, Transmission Details, Drive—Current and Current Control: Battery Equipment, Controller, Safety Devices—Types

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GASOLINE TAXICABS: Foreign and American Types—Assembled Cabs

DELIVERY WAGONS: Requirements—Design—Load Efficiency—Autocar Type—White Type—Lippard-Stewart—British Vans

GASOLINE TRUCKS: Advantages — Design — Ignition—Carbureters—Cooling System—Lubrication—Motor Governors: Motor Location—Clutches—Transmissions—Final Drive

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GASOLINE VEHICLES (Continued): Electric Transmission: Storage-Battery, Entz System—Hydraulic Transmission: Pump Control, Brake

CHASSIS AND RUNNING GEAR: Springs: Types, Auxiliaries, Bumpers—Brakes: Types, Power Brakes—Frame Design: Types, Rolled Shapes, Bracing—Wheels: Materials, Tests

TIRES: Materials—Types—Efficiency Tests—Mileage—Abuses

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OMNIBUSES: London—Paris—New York—Interurban—Char-a-bancs

FIRE APPARATUS: Hose and Chemical Wagons—Motor-Pumping, Gasoline-Electric, and Electric Types—Trailers: Advantages, Types, Efficiency, Standard Trucks

TRACTORS: Advantages—Road Trains — Tractor Trains — Foreign Trains — American Practice

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TRACTION ENGINES: Usefulness—Motor Design—Transmission—Steam Vehicles: Flash Generator, Operating Cost

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OPERATING COST: Fuel—Lubricant—Tires—Comparative Costs—Depreciation—Loading and Unloading—Abuses—Motor Truck in War

COMPRESSED AIR—Prepared by LUCIUS I. WIGHTMAN, E. E., Consulting Engineer and Counsellor in Technical Advertising, New York City

Part I

PRODUCTION OF COMPRESSED AIR: Air and Other Gases—Theory and Principles of Compressors—Indicator Card—Cooling—Single- and Multi-Stage Compression—Limiting Pressures—Antecoolers, Intercoolers, and Aftercoolers—Air-Washers—Compressor Design and Efficiencies—Clearance—Compressor Types (Vertical, Horizontal; Straight-Line, Duplex; Simple and Compound Steam)—Power Driving—Steam and Air Valves and Pressures—Compressor Regulation

Part II

TRANSMISSION OF COMPRESSED AIR: Receivers—Pipe Lines—Valves, Bends, etc.—Loop System—Dense Air System

APPLICATION OF COMPRESSED AIR: Preheating, Interheating, and Reheating—Air-Motors—Rock Drills — Air-Hoists—Pneumatic Tools (Hammers, Rock-Drills, etc.)—Pneumatic Pumps (Direct-Acting, Displacement, Air-Lift, and Return-Air)—Air-Brakes—Stone Channelers — Coal-Cutting Machines — Pneumatic Haulage — Compressed-Air Locomotives—Electric-Air Principle

CONSTRUCTION OF BOILERS—Revised by R. H. KUSS, M. E., Sales Manager, Edge Moor Iron Co., Chicago

BOILER MATERIALS: Physical Tests—Testing Machines—Rules for Testing Boiler Steel—Allowable Pressure

BOILER MANUFACTURING PROCESSES: Riveted Joints: Drilled vs. Punched Holes, Forms of Rivets, Driving Rivets, Flanging, Types of Joints, Calking, Welding in Boiler Construction, Arrangements of Plates and Joints—Manholes—Stays: Simple Rods, Diagonal Stays, Stiffening Angles, Crown Sheet Supports—Boiler Tubes and Flues: Tube Spacing, Expanding Tubes, Furnace Flues

BOILER REQUIREMENTS: Boiler Horsepower—General Requirements—Grate Area—Boiler Rating—Steam Space—Heating Surface—Allowable Pressure

CONTRACTS AND SPECIFICATIONS—Prepared by JAMES C. PLANT, Superintendent of Computing Division, Office of Supervising Architect, Washington, D. C.

Part I

GENERAL AND SPECIFIC CONDITIONS: Outline of Work—Studies in Materials—Lumber for Construction and Finish—Roofs—Use of Words and General Requirements—Electric Wiring—General Conditions—Drawings—Specifications—Architect—Payments—Time—Site—Excavation—Masonry Materials—Masonry Construction—Carpentry Construction—Hardware—Plumbing—Heating—Proposal Sheet—Form of Agreement between Owner and Builder—Government Contracts—Number and Value of Buildings Concerned—Bonds

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GENERAL SCOPE OF THE SPECIFICATIONS: Specification Reminder—General Conditions—Specification—Material and Labor—Contractor—Architect—Drawings and Specifications—Time for Completion—Excavation—Preparation of Site—Walls—Cement Coating—Drain Pipes and Cesspools—Cellar Floor—Brickwork—Carpenter Work—Hardware—Painting—Glazing—Heating—Plumbing—Fixtures—Water Supply—Gas-fitting

COST ANALYSIS ENGINEERING—Prepared by DEWITT V. MOORE, District Engineer, Division of Valuation, Interstate Commerce Commission

Part I

REQUIREMENTS OF PERSONNEL: Experience in Estimating, Construction, Office and Clerical Duties, Cost Analysis, and Supervision

CONSTRUCTION AND EQUIPMENT DETAILS: Discounts—Interest Charges—Schedules for Estimates—Progress Estimates—Rental—Depreciation—Obsolescence—Operation—Repairs—Petty Tools

ADMINISTRATION AND CONSTRUCTION ORGANIZATION: Line, Shaft, and Departmental Organization—General, Sub-, and Special Contracting

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COST ANALYSIS: Original Estimate vs. Final Estimate—Checking Quantities and Labor Costs—Simple Comparative Units

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QUANTITY SURVEYS AND ANALYSIS: English and U. S. Methods—Cost of Surveys—Actual vs. Estimated Quantities—Detailed Field vs. Bookkeeping Records—Actual vs. Contract Costs—Material Price Schedule—Labor Rates

DAMS AND WEIRS—Prepared by W. G. BLIGH, M. Inst. C. E., (London). Inspecting Engineer of Irrigation Works, Department of Interior, Canada

Part I

GRAVITY DAMS: Elementary Theory—Theoretical Profile—Practical Modifications—Graphical and Analytical Calculations—Application to Details of Design—Design of Base of "High" Dam—Analysis of Characteristic Sections of Dams

GRAVITY WEIRS: Water Pressure on Back of Wall—Base and Crest Width—Moments of Water Pressure at Different Heads—Examples of Existing Weirs

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- ARCHED DAMS:** Statical Conditions Involved—Stresses in Arch Ring—Theoretical Profiles—Action of Water Pressure—Design of Existing Arched Dams
- ARCH BUTTRESSED DAMS:** Cost Economy—Mir Alam Dam: Description and Analysis—Belubula Dam—Design of Arch Buttressed Dam—Other Examples of Design
- SUBMERGED WEIRS IN SAND:** Exposure to Destructive Influences—Percolation under Embankment—Vertical Depression—Rear Apron—Example of Design under Actual Conditions—Crest Shutters—Sloping Apron—Loose Rock Weirs—Illustrative Designs
- OPEN DAMS AND WEIRS:** Function of Weir Sluices—Analysis of Design—Pressure on Foundations—Draw Gates—Stony and Roller Gates—Hydraulic Shutters—Automatic Shutters

DIRECT-CURRENT DYNAMOS—Prepared by FRANCIS B. CROCKER, E. M., Ph. D., Professor of Electrical Engineering, Columbia University; and MORTON ARENDT, E. E., Assistant Professor of Electrical Engineering, Columbia University, New York

Part I—PRINCIPLES

- FUNDAMENTAL PRINCIPLES:** Units—Magnetic Field—Solenoid—Toroid—Magneto Electric Induction—Magneto Motive Force—Reluctance—Magnetic Permeability—Magnetization Curves—Residual Magnetism—Hysteresis—Induced Currents—Magnetic Flux
- GENERATORS:** Elementary Generator—Armatures—Cores—Field Magnets—Voltage Regulation—Methods of Compounding—Actions in the Armature—Cross-Magnetizing Effects—Commutation—Elimination of Sparking—Compensation—Eddy Currents—Stray Power

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- ARMATURE WINDINGS:** Winding Element—Commutator Bars—Pitch—Ring Windings—Drum Windings—Wave Windings—Lap Windings—Length of Armature Winding—Armature Resistance—Armature Losses—Heating
- COMMUTATOR AND BRUSHES:** Segments—Size—Losses—Heating
- MECHANICAL PARTS:** Shafts—Armature Spider—Binding Wires—Bearings—Friction and Windage Losses—Efficiency
- CHARACTERISTIC CURVES:** Magnetization Curve—External Curve—Characteristic Curves for Separately-Excited Machines—Series Wound, Shunt Wound, Compound Wound Generators

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- CONSTRUCTION OF FRAME:** Magnet Yoke—Field Poles
- ARMATURE CONSTRUCTION:** Core Bodies—Armature Teeth—Core Plates and Disks—Ventilating Ducts—Binding Wires—Conductors—Drum Windings—Ring Windings—Arrangement of Conductors in Slots—Commutator Bars—Insulation—Brushes—Rocker Arms
- MECHANICAL PARTS:** Bearings—Pedestals—Lubrication—Bead Plates
- DESIGN OF A CONTINUOUS CURRENT GENERATOR:** Specifications—Number of Poles—Armature Dimensions—Magnetic Flux—Armature Conductors—Commutator Segments—Commutator—Winding—Slots—Air Gaps—Pole Cores—Yoke—Excitation—Voltage Drop Compensation—Field Winding—Heating—Sparking—Detail Sheet

DIRECT-CURRENT MOTORS—Prepared by LOUIS DERR, S. B., A. M., Professor of Physics, Massachusetts Institute of Technology

- PRINCIPLES:** Comparison between Dynamos and Motors—Counter E. M. F.—Fundamental Equation—Efficiency and Losses—Torque—Armature Reaction—Speed Formula
- SHUNT MOTORS:** Armature Reaction—Direction of Rotation—Starting Resistance—Electrical Connections—Automatic Release—Wiring Connections—Overload Release—Operation of Motor: Starting, Stopping, Reversing, Automatic Starters, Reversing Starters, Speed Control

SERIES MOTORS: Direction of Rotation—Speed and Torque Curves—Starting Rheostat—Speed Control—Railway Motors—Automobile Motors—Compound Motors
MOTOR PRACTICE: Multi-voltage Systems—Mechanical Points of Motor Design—Electrical Points of Motor Design

EARTHWORK—Prepared by A. B. McDANIEL, B. S., Assistant Professor of Civil Engineering, University of Illinois

Part I

SCRAPERS: Slip—Two-Wheel—Four-Wheel
GRADERS: Two-Wheel Blade — Four-Wheel Blade — Reclamation—Elevating—Cost of Operation
POWER SHOVELS: Fixed and Revolving Platform Types: Platforms, Power Equipment, Excavating Equipment, Operation, Cost—Electrically Operated Shovels—Efficiency and Economy
DRY-LAND EXCAVATORS: Stationary Scrapers—Revolving Excavators—Operation Cost —Templet, Wheel, and Tower Excavators—Walking Scoop Dredges—Walking Drag Line Excavators

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FLOATING EXCAVATORS: Dipper, Ladder, and Hydraulic Dredges: Construction, Operating and Excavating Equipment, Material Distributing Machinery, Method and Cost of Operation
SUB-AQUEOUS ROCK BREAKERS: Lobnitz Rock Cutter—Drill Boat
TRENCH EXCAVATORS: Traveling Derrick—Continuous Bucket, Trestle-Cable, and Trestle-Track Excavators—Tower Cableway—Hovland Tile Ditcher

ELECTRICAL EQUIPMENT FOR GASOLINE CARS—
Prepared by CHARLES B. HAYWARD, Consulting Engineer

Part I

IGNITION: Fundamental Principles — Low Tension System — High Tension System — Primary Batteries—Storage Cells—Contact Makers or Timers—Coils and Vibrators—Distributors—Spark Plugs—Low-Tension Magneto—High-Tension Magneto
IGNITION SYSTEMS: Dual, Duplex, and Double-Spark Types—Ford Magneto—High Frequency Ignition Systems: Lodge, Seeley, Hi-Fre-Company Dual—Spark Timing—Firing Order—Wiring—Magneto—Mounting—Modern Battery Ignition Systems—Generator Design—Testing—Adjustment and Maintenance

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ELECTRIC LIGHTING: Incandescent Lamps—Lighting Batteries—Reflectors—Headlight Glare—Dimming Devices—Lighting Generators—Generator Drive: Silent Chain, Auxiliary Shaft, Gear, Double Deck Units, Motor-Generator or Transmission Housing, Fly-wheel Direct Drive — Voltage Regulation — Constant-Current Generators — Constant-Potential Generators—Problems of Lighting Circuit
STARTING DEVICES: Mechanical, Compressed Air and Gas, Electric: Motor Requirements, Starting Speeds, Voltage, Motor Windings and Poles, Installations, Driving Connections, Automatic Engagement, Clutches, Back-Kick Release—Electric Horns—Electric Brakes

ELECTRICAL MEASUREMENTS—Prepared by O. J. BUSHNELL and A. G. TURNBULL, Meter Department, Commonwealth Edison Company

Part I

UNITS OF MEASUREMENT: C. G. S. System—International Units—Primary Standards —Ohm's Law
ELECTRICAL MEASURING INSTRUMENTS: Voltmeter—Wright Electrolytic Meter—Whitney Hot-Wire Instruments—Tangent, D'Arsonval and Ballistic Galvanometers—Voltmeters — Ammeters—Thomson Inclined Coil Meters — Dynamometers — Induction Electrometers—Frequency Meters—Power Factor Meters

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ELECTRICAL PRINCIPLES—Prepared by EDWARD B. WAITE, Formerly Dean, and Head, Consulting Department, American School of Correspondence; and J. P. SCHROETER, Consulting Engineer, Electrical Engineering Department, American School of Correspondence

ELEMENTS: Magnets—Magnetic Field—Condensers—Electric Current—Primary Cells—Combinations of Batteries—Electromagnet—Telegraph—Bell

LAW OF CURRENT FLOW: E. M. F.—Current Resistance—Specific Resistance—Temperature Coefficients—Ohm's Law—Divided Circuits

WIRING METHODS: Specifications—Wiring Building—Outlet-Boxes—Arc Lamps—Running Circuits in Motion Picture Theater

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INTRODUCTORY: Early Electric Vehicles—Essential Features—Electrics Abroad

STORAGE BATTERY: Construction and Action of Typical Cell—Cell Plates—Capacity—Life of Cell—Types—Improved Forms—Starting Batteries

MOTOR: Essentials—Armature—Capacity for Overloads—Parts

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CONTROL: Controllers: Drum, Flat Radial, Flush, Duplex—Wiring Diagram—Fuses—Electric Brakes

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CHARGING BATTERY: Sources of Current—Motor-Generator—Mercury-Arc Rectifier—Temperature of Battery—Charging Rate—Automatic-Charge Stopping Device—Overcharging—Charging an Edison Battery—Boosting the Battery: Advantages, Regulation, Table of Rates

CARE OF BATTERY: Limits of Discharge—Sulphating—Condition of Cells—Washing—Lead Burning—Recharging—Freezing

POWER LOSSES: Non-Alignment of Steering Wheels and Axles—Worm Chains and Sprockets—Dry Bearings—Armature Troubles—Tires and Mileage

DRIVING ELECTRIC: Starting—Coasting—Stopping—Speeds—Meter

ELECTRIC LIGHTING—Prepared by GEORGE C. SHAAD, E. E., Professor of Electrical Engineering, University of Kansas

INCANDESCENT LAMPS: Ordinary Carbon Filament—Gem Metallized Filament—Tantalum Lamps—Tungsten Vacuum Lamps: Method of Preparing Filament, Improvement Over Carbon Type—Nitrogen-Filled Lamp—Nernst Lamp—Distribution Curves

SPECIAL LAMPS: Standard Mercury Vapor Lamp—Quartz Mercury Vapor Lamp—Moore Tube Light—Neon Tube Light

ARC LAMPS: Principle of Electric Arc—Carbon Feed Mechanisms—Open and Enclosed Arcs: Direct-Current Types, Alternating-Current Types, Interchangeable Types—Flaming Arc Lamps—Luminous Arc Lamps—Comparison

POWER DISTRIBUTION: Series System—Multiple-Series or Series-Multiple Systems—Multiple Systems—Multiple-Wire Systems

ILLUMINATION: Units—Intrinsic Brightness—Regular and Irregular Reflection—Residence Lighting—Lighting of Public Halls, Offices, etc.—Direct Lighting—Indirect Lighting—Semi-Indirect Lighting—Street Lighting—Train Lighting: Straight Storage Battery System, Head-End Generator System, Axle Generator System, Data Covering Various Types of Equipment

SHADES AND REFLECTORS: Frosted Globes—Holophane Globes—Metal Reflectors—Decorative Shades—Special Reflectors—Incandescent Street Lighting

PHOTOMETRY: Light Standards—Types of Photometers—Incandescent Lamp Photometry—Arc Lamp Photometry

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Part I

ROLLING STOCK AND EQUIPMENT: Car Body: Frame, Sides and Ends, Roof, Vestibule—Trucks: Single, Double, Truck Details—Motors: Direct-Current Series Type, Operating Characteristics, Use of Motor Curves, Alternating-Current Type—Controllers: Manual Controller, Multiple Unit Controller—Automotoneer

Part II

BRAKES AND BRAKING: Peacock Brake—Air Brakes: Straight Type, Air Compressor, Pump Governor, Brake Cylinder, Operating Valve, Operation—Miscellaneous Car Equipment: Trolley, Heaters, Lighting Systems, Draw Bars and Couplers, Electric Devices—Mechanics of Car Movement: Curve Resistance, Grade Resistance, Braking, Coasting, Application of Mechanical Principles—Maintenance of Rolling Stock: Inspection, Locating Defects in Motor and Controlling Wire

Part III

POWER PLANTS: Power House Construction and Arrangement: Pole Circuit, Feed Water, Steam Circuit, Power Circuit—Heat and Other Energy Transformation: Small Reciprocating Engine Plant, Railway Plant, St. Claire Tunnel Power Plant—Electrical Details of Power Plants: Direct-Current Machines, Alternating-Current Machines—Cost Details of Power Plant—Substations

TRANSMISSION: Wires—Poles and Towers—Insulators—Overhead Construction: Trolleys and Fastenings—Third Rail Construction: Supports, Protection, Bonding—Track as Return Circuit—Feeder Systems—Stray Currents—Signal Systems

Part IV

TRACK CONSTRUCTION: Rails: Types, Rail Joints—Track Support—Special Work—Special Track Construction

STEAM RAILWAY ELECTRIFICATION: Electric Locomotives: Direct-Current Type, Alternating-Current Type—Single Phase and Polyphase—Distribution of Power for Heavy Traction

ELECTRIC TELEGRAPH (THE)—Prepared by CHARLES THOM, Chief, Quadruplex Department, Western Union Main Office, New York City

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APPARATUS AND THE MORSE CODE: Alphabet—Messages—Automatic Sounder Method—Faults of the Beginner—Main Line Circuit—Method of Wiring—Switchboard—Cipher Message—Cable Message—Marine Message—Abbreviated Telegraphy—Messages for Practice—Railways Telegraph

Part II

APPARATUS AND METHODS OF WORK IN THE LARGER OFFICES: Recent form of Switchboard—Method of Relay Installation—Dynamo in Telegraphy—Description of Different Types—Open-Circuit System—Single-Line Repeaters—Sketch Showing Milliken Repeater in Theory—Atkinson Repeater—Sketches Showing Theory—Weiny-Philips Repeater—Multiplex Telegraphy—Stearns Duplex—How to Balance—Polar Duplex—Quadruplex—Theory—Operation—Troubles of the Quad—Duplex Repeater—Repeating Sounder—Phonoplex

ELECTRIC WIRING—Prepared by CHARLES E. KNOX, E. E., Consulting Electrical Engineer

METHODS: Rigid Conduit—Flexible Metal Conduit—Armored Cable—Molding—Concealed Knob and Tube Wiring—Exposed on Insulators—Two-Wire System—Three-Wire System

CALCULATION OF SIZES OF CONDUCTORS: Direct Current—Alternating Current

PLANNING A WIRING INSTALLATION: Method and System—Location of Outlets—Feeders and Mains—Wiring an Office Building—Outlet Boxes—Bushings—Fuse Boxes—Panels

LINE WORK: Overhead—Poles—Insulators—Lightning Arresters—Underground Work—Conduits—Cables—Manholes

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ANALYSIS OF TERMS: Instantaneous Values: Cycle, Period, Frequency, Commercial Frequencies, Ohm's Law for Instantaneous Conditions, Steady and Unsteady States, Initial States in D. C. Circuit—Inductance: Cutting Lines of Force, Self-Induction, Increasing Currents in Inductive Circuits, Time Constant, Power Relations, Decreasing Currents in Inductive Circuits, Storage of Energy—Capacity: Condenser, Theory and Process of Charging Condenser, Quantity of Electricity, Capacity of Conductors, Electrostatic Field, Discharge of Condenser—Oscillatory Circuits: Application to Wireless Work

SINGLE-PHASE CIRCUITS: Generation of Simple Alternating Currents: Angular Speed, Instantaneous Flux, Alternating E. M. F.—Commercial Alternators—Sinusoidal and Non-sinusoidal E. M. F.'s—Effective Values of Alternating Currents—E. M. F. and Current Relations for Sinusoids: E. M. F. Relations in Series Circuit, Phase Relations, Graphical Representation of Sinusoids, Complex Quantity Notation: Operator, Resolution of Vectors into Components, Vector Addition—Series Alternating-Current Circuits: Impedance, Resistance, Reactance, E. M. F. and Current, Power in Series Circuit, Power Factor, Power from Complex Quantity Diagram, Power Supplied to A. C. Motor—E. M. F. and Current in Parallel Circuits: Conductance, Susceptance, Admittance, Power in Terms of Conductance—Summary of Alternating-Current Equations—Illustrative Problems

THREE-PHASE CIRCUITS: Comparison with Single-Phase Circuits: E. M. F. in External Circuit, Vector Notation, E. M. F. Induced in Coil—E. M. F. between Mains—Connection of Loads to Three-Phase Circuit—Power in Balanced Circuits—Illustrative Problems

ELEMENTS OF ELECTRICITY—Prepared by ROBERT A. MILLIKAN, Ph. D., Professor of Physics, University of Chicago; and E. S. BISHOP, Ph. D., Instructor in Physics, University High School, Chicago

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BEGINNINGS OF ELECTRICITY: Magnetism: Magnets, Attraction and Repulsion, Magnetic Induction, Lines of Force, Field of Force, Nature of Magnetism, Earth's Magnetism, Declination, Dip—Static Electricity: Friction, Positive and Negative Electricity, Coulomb's Law, Two-Fluid Theory, Electron Theory, Electroscope, Charging by Induction, Lightning and Lightning Rods, Electric Potential, Condensers, Electroscopes, Electrostatic Generators—Electric Currents: Galvanic Cell, Magnetic Field About a Current, Galvanometers, Measurement of Current, Measurement of E. M. F., Measurement of Resistance, Ohm's Law, Primary Cells (Theory, Polarization, Types of Cells, Combinations of Cells)

Part II

MEASUREMENT AND APPLICATIONS OF ELECTRIC CURRENT: Ohm's Law—Applications of Ohm's Law—Series Circuits—Divided Circuits—Joint Resistance—Resistance of Battery Circuits—Electrolysis—Laws of Resistance—Resistance Tables—Measurement of E. M. F.—Resistance Measurement Methods—Electromagnetism: Magnetic Properties of Helix, Electromagnet, Applications, Telegraph System—Chemical Effects of Current: Electroplating, Electrotyping, Refining Metals, Storage Batteries—Heating Effect of Current: Incandescent Lamps, Arc Light—Household and Artisan Devices

Part III

INDUCED CURRENTS: Strength of Induced E. M. F.—Principle of Dynamo—Principle of Motor—D. C. Generator and Motor Applications—Back E. M. F. in Motors—Properties of Circuits Carrying Alternating Currents—A. C. Generator and Motor Applications—Principles of Induction Coil and Transformer—Simple Telephone—Modern Applications

ELEMENTS OF FIRE INSURANCE—Prepared by EDWARD R. HARDY, Ph. B., New York Fire Insurance Exchange. Lecturer on Insurance, New York University; and PETER JOSEPH McKEON, A. B., Consulting Engineer on Fire Insurance and Fire Protection

GENERAL STUDY: Description and Definitions—Reason for Fire Insurance—History—Principles—As a Public Function—Details of Policy

FIRE INSURANCE AS A TRANSACTION: Application for Insurance—Temporary Insurance—Inspecting Property—Making Rate—Approving Risk—Writing Policy—Paying Premium—Occurrence of Fire—Adjusting Loss

FIRE INSURANCE AS A BUSINESS: Joint Stock Company—Mutual Company—Reciprocal Underwriters—Individual Underwriters—Indemnity Exchange—Lloyds

METHODS AND ORGANIZATION: Stock Company—Mutual Company—Manufacturers' Mutuals

FIRE INSURANCE ASSOCIATIONS: Underwriting—Rating—Inspection—Engineering—Salvage

DEPARTMENTS AND BRANCHES: General Business Management—Financiering—Special Business Management—Inspection Department—Rating—Adjusting—Underwriting—Agency—Brokerage

ELEVATORS—Prepared by J. H. JALLINGS, Mechanical Engineer. For Twenty Years, Superintendent for J. W. Ready Elevator Company

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HAND POWER TYPES: Early Types—Platform—Guide Rails—Anti-friction Bearings—Counterbalancing—Weights—Wire Ropes—Safety Appliances—Brake—Special Cases—Basement Elevator Types—Dumb-Waiters

BELT POWER TYPES: Spur-Gear Winding Machine: Drums, Countershaft, Pulleys, Overhead Drum Safety Device—Worm Gear Winding Machine: Details of Worm and Gear, Thrust, Hob—Engine Drive—Motor Drive—Center Line—Slack—Cable Stop—Belts—Belt Shipper

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HYDRAULIC TYPE: Early Forms—Operating Valve—Hale Water Balance Elevator—Hale Standard—Multiple Cylinder Type—Pull and Push Machines—Limit Valve—Cable Guard—Compression Tank—Pilot Valve—Operating Lever Device—High Pressure Hydraulic Type: Pressure, Difficulties—Reverse Plunger Type—Direct Plunger Type: Use of Counterpoise, Traveling Stay for Plunger

Part III (Electric)

EARLY TYPES AND DEVELOPMENTS: Motor Design: Requirements, Faults, Heating, Modern Types—Control: Function of Controller, D. C. and A. C. Types—Transmission: Location of Engine, Single and Tandem Gear, Speed and Load Variations—Winding Drum, Counterpoise—Traction Elevators: Drum and Cable Arrangement, Limit Stops, Buffers, One-to-One Type, Herring-Bone Gear Type, Miscellaneous Types

Part IV (Equipment)

ELEVATOR ACCESSORIES: Guide Posts and Guides—Platforms and Cages—Counterpoise Weights—Power Required: Hand, Steam, Hydraulic, Electric—Proportioning the Parts: Factor of Safety, Hooks, Drum Shaft, Gears, Sheaves, Bearings, Wire Cables, Fasteners, Valves, Cylinders, Cross-Head—Automatic Stops and Other Safeties—Inclosures—Cabs—Doors—Gates

ESTIMATING—Parts I and II prepared by EDWARD NICHOLS, Architect, Boston, Massachusetts; Part III prepared by HENRY JACKSON BURT, B. S., C. E., Structural Engineer with Holabird and Roche, Chicago

Part I

PRINCIPLES: Prices Defined—Catalogues—Profit—Percentage—Duplicate Parts—Transportation—Approximate Estimates—Estimating by the Square, by Quantities—Preparation—Units—Rules—Measure of Lines and Surfaces—Areas of Solids—Scale of Wages—Excavation—Stone Work—Window Sets—Face Bricks Complete in Wall—Cost of Concrete—Cost of Chimneys—Prices of Masons' Supplies—Vitrified Pipe—Prices of Lumber—Stairs—Piazas and Porches—Hardware—Roofing—Plastering—Painting—Hot Water and Steam Heating—Plumbing—Gas Fitting—Electric Light Wiring

Part II

METHOD OF TAKING OFF QUANTITIES: Estimate of Residence, Showing Method of Taking Off Quantities and Cost of Same—Excavation—Stonework—Plastering Walls with Cement—Brickwork—Estimating Total Cost of Concreting, of Plastering—Freight—Fares—Insurance—Total Cost of Carpenter Work, of Stairs, of Heating—List Giving Itemized Cost for Complete Installation of Waste and Soil Pipes—Electric Wiring—Total Cost of Residence—Location Sheet of Electric Outlets

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ESTIMATING STRUCTURAL STEEL FOR BUILDINGS: Units—Degrees of Accuracy—Variation from Theoretical Weight—Basis of Estimates—Estimating Weights: Forms, Listing Material, Standard Material, Computing Weights, Checking, Approximate Estimates—Estimating Costs: Plain Material, Transportation from Mill to Shop, Shop Detail Drawings, Paint and Painting, Transportation from Fabricating Shop to Building Site, Profit, Summary

EXPLOSION MOTORS—Revised by MORRIS A. HALL, B. S., Formerly Managing Editor, "Motor Life"

ELEMENTARY PRINCIPLES: Historical—Explosion-Motor Cycle: Four-stroke Cycle, Two-stroke Cycle, Six-stroke Cycle—Types of Explosion Motors: Automobile Motors, Marine Motors, Motorcycle Motors, Aeronautical Motors

MOTOR DETAILS: Four-Cycle Type—Valves—Ignition—Lubrication—Cooling—Clutch—Crank and Firing Arrangements—Two-Cycle Type—Four-Cylinder Motor—Eight-Cylinder Motor—Power—Governor

THERMODYNAMICS: Indicators—Manograph—Thermal Efficiency—Otto Cycle in Practice: Suction, Compression, Explosion and Exhaust Strokes—Modifications for Modern Motors—Fuels—Horsepower and Rating Calculations

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FIRE INSURANCE BROKER—Prepared by EDWARD R. HARDY, Ph. B., New York Fire Insurance Exchange. Lecturer on Fire Insurance, New York University

THE BROKER: Origin—Early Activities—Service Rendered—Placing Insurance—Preparation of Forms—Reducing Rates—Suggesting Improvements—Consulting—Settlement of Losses—How Paid—Brokerage a Profession—Increasing Standard—Modern Broker's Office—Organization—Art of Soliciting

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MILL CONSTRUCTION: General Specifications—Floor Construction—Floor Openings—Partitions—Finish—Roof—Engine and Boiler House—Fire Resisting Mill Construction—Reinforced Mill Construction—Fire Walls and Fire Curtain—One-Story Storehouse—Four-Story Storehouse—One-Story Workshop—Saw-Tooth Roof Construction

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VALVES: Gate and Check Valves—Alarm Valve—Dry Pipe Valves—Air Supply—Protection

MAINTENANCE OF SPRINKLER SYSTEM: Installation—Care and Supervision—Care of Heads—Records of Risks—Outside Sprinklers—Window Sprinklers

STANDPIPES: Size—Water Supply—Installation

FIRE PAILS: Forms—Distribution and Location—Maintenance

CHEMICAL EXTINGUISHERS: Approved Types—Underwriters' Specifications—Pyrene Extinguisher

ALARM SYSTEM: Automatic Sprinkler Alarm Systems—Manual System—Automatic System—Thermostats—Watchman's Service

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PUMPS: Intake Wells—Reciprocating Pumps: Double-Acting, Air and Vacuum Chambers, Duplex and Triplex—Steam Valves—Rotary Pumps—Centrifugal Pumps—Screw Pumps—Types of Valves—Underwriters' Standard Pump Specifications—Sources of Power: Steam, Electricity—Methods of Automatic Control—Pump Houses

PIPE DISTRIBUTING SYSTEMS: Pipe—Gridiron Systems—Designing System: Fire Systems, Valves, Separating Supplies, Hydrants, Hose Houses—Electrolysis—Frost Line—Conclusion

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ORDINANCES: Building Laws—Electrical Laws—Laws Covering Explosives, Inflammables, and Rubbish

Part VI (COMMON AND SPECIAL HAZARDS)—Prepared by J. ALBERT ROBINSON, Fire Protection Engineer

GENERAL HAZARDS: Name of Assured—Classification of Business—Employees—Description of Occupancy—Stock—Machines—Materials Used

DANGEROUS HAZARDS: Gasoline—Rubber Cement—Paints and Oils—Celluloid—Loose Packing Material—Bituminous Coal—Hazardous Processes—Dust—Rubbish—Cooking—Laundry—Fumigating—Celebrations—Workmen Smoking

CLASSES OF HAZARDOUS RISKS: Dye Works—Breweries—Cotton Seed Mills—Flour Mills—Pulp Mills—Bakeries—Sugar Refineries—Tobacco Factories—Woodworking Mills—Waste—Sawdust—Chutes and Conveyors—Oils, etc.

FIRE INSURANCE LAW (INCLUDING STANDARD POLICY)—Prepared by EDWARD R. HARDY, Ph. B., New York Fire Insurance Exchange. Lecturer on Fire Insurance, New York University

Part I

INTRODUCTORY: Policy a Contract—Insurable Interest—Early Policy Forms: Proposal, Brief, Sun Fire Office, Insurance Company of North America, United States Fire Insurance Company—Massachusetts Standard Policy—Uniform Policy

Part II

STANDARD POLICY IS INSURANCE LAW: Verbal Contract—Binder—Standard Time—Loss and Damage by Fire—Location of Risk—Description of Property—Limit of Company's Liability—Cash Value of Property—Provisions for Loss—Penalties for Concealment and Misrepresentation—Changes by Agreement—Company's Ignorance of Hazard—Liability of Company in Time of Riots—Earthquake Losses—Renewal of Policy—Cancellation—Mortgaged Policy—Policy not Promissory Note—Loss Settlements

LAW APPLIED TO STANDARD POLICY: Representations and Concealments—Warranty—Waiver and Estoppel

Part III

STANDARD CLAUSES, OR RIDERS: Application and Survey—Percentage Value—Co-insurance—Assessment—Installment or Credit—Conditions as to Incumbrances—Lightning—Mortgages—Agency Certificate—Averages—Forbidding Use of Electricity

FACSIMILES OF POLICIES AND FORMS: Massachusetts—New York—California—Forms Attached to Policy

FIRE INSURANCE RATING—Prepared by EDWARD R. HARDY, Ph. B., New York Fire Insurance Exchange. Lecturer on Insurance, New York University

Part I

EARLY RATING METHODS: Definitions—History—Group System—Special Hazards—Wool Tariff—Methods in the United States—Fixed Base Rate—Classes of Hazards

SCHEDULE RATING: National Board—Rating Organizations: Duties, Methods, Justification for Existence, Work Distinct from Insurance Companies—Executive Organization—Making a Schedule—"Minimum Rate" Risks—Special Rating

Part II

UNIVERSAL MERCANTILE SCHEDULE: Fundamental Principles—Making a Key Rate—Schedule for Non-Fireproof Building: Discussion of Building Charges and Deductions, Contents Rate, Special Features, Exposure Tables—Schedule for Fireproof Building: Early Rates for Fireproofing, Universal Rates, Discussion of Building Charges and Deductions, Contents Rate, Graded Occupancy Charges, Sprinklers

Part III

DEAN ANALYTIC SCHEDULE: Mercantile Classes—Items Considered in Computing Rate: Height, Area, Walls, Roof, Ceilings, Skylight, Floor Openings, Partitions, Chimneys, Outside Attachments, Occupancy, Protection and Exposure—General Problems: Rent Insurance, Use and Occupancy, Lease Insurance, Commissions and Profits, Pawnbrokers, Blanket Policies, Builder's Risk, Coinsurance, Loss by Ordinance, Term Policies, Clauses and Warranties—Final Considerations

FIRE INSURANCE UNDERWRITING—Prepared by EDWARD R. HARDY, Ph. B., New York Fire Insurance Exchange.
Lecturer on Fire Insurance, New York University

IMPORTANT RESPONSIBILITIES CONNECTED WITH UNDERWRITING: Avoidance of Unprofitable Risks—Selection of Desirable Ones—Wide Distribution of Lines in Class and Territory Essential—Discrimination between Good and Bad Construction—Safe and Unsafe Risks—Adequate Rates—Wide Information as to All Classes of Business—Knowledge of All Processes in Different Businesses Insured—Knowledge of Law of Contracts, Agency, and Especially of Insurance Law—Acquaintance with All Branches and Departments of Business—Ability to Give Proper Prominence to All Factors—Mathematical Aspect of Line Choosing or Placing—Law of Averages—Financial Aspect—Factors beyond Underwriters' Control

FIREPROOF CONSTRUCTION—Prepared by F. W. FITZPATRICK, Consulting Architect (formerly of U. S. Service); and THEODORE L. CONDRON, M. S., Consulting Civil Engineer

Part I

STIMULUS TO GOOD BUILDING: Legislative Control—Remission of Taxes—Labeling Buildings—Neighboring Liability—Public Opinion—Building Conditions in American Cities—Large Proportion of Poor Buildings—Good Buildings Skimped—Comparisons with Europe

VALUE OF FIREPROOF CONSTRUCTION: Importance of Good Design—Fireproofing as an Investment—Insurance vs. Fireproof Construction—Real Economy—Adoption of Safe Construction

FIREPROOF BUILDING: Popular Misconceptions—Contents and Finish—Isolated Units—Steel and Tile or Concrete Frame—Wire Glass—Metal Doors—City Unburnable—Municipal Regulations—Attitude of Architects

Part II

EVOLUTION OF BUILDING CONSTRUCTION: Early Forms—Stone and Brick—Unprotected Iron and Steel—Tile Protection—Corrugated and Plate Floor Construction—Mill Construction—Other Retardants—Steel-Frame Buildings—Reinforced Concrete—Steel and Tile vs. Reinforced Concrete

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FIREPROOF BUILDINGS IN DETAIL: Outside Walls—Ornamental Surface—Wall Openings—Roofing—Piers and Foundations—Structural Parts—Tile Protection—External Light Courts—Stairs and Elevator Shafts—Halls and Exits—Shafts—Use of Wood—General Fireproof Features—Wall Finish—Furnishings—Special Requirements—Theater—Church—Hotels—Fireproof Homes—Building Code—Standard Tests of Building Materials—Methods of Retarding Fires

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CONCRETE FROM THE FIRE-RESISTING STANDPOINT: Concrete as a Building Material—Behavior under Fire—Proportions—Construction Developments Due to Concrete—Fire-Resisting Qualities—Fires in Concrete Buildings—Laboratory Tests of Concrete and Other Materials

FORGING—Prepared by JOHN LORD BACON, Consulting Engineer

METHODS AND MATERIALS: Equipment—Fires—Oxidizing and Reducing Fires—Banking Fires—Difference between Welding and Brazing—Proper Heat for Welding—Use of Scarfs—Fagot and Lap Weld—Allowance of Stock for Welding—Calculation of Stock for Bent Shapes—Forging Operations—Simple Forging—Calculation of Stock for Forged Work—Tool-Steel Work—Hardening Baths—General Laws of Hardening—Annealing—Tempering—Lead Bath—Tool Forging and Tempering—Heavy Forging—Miscellaneous Processes—Manufacturing.

FOUNDRY WORK—Prepared by WM. C. STIMPSON, Formerly Head Instructor in Foundry Work and Forging, Department of Science and Technology, Pratt Institute

Part I

MOLDING AND CORE MAKING: Core Making—Dry Sand Molding—Loam Work—Materials—Facing—Distinction between Blackings and Facing Sand—Miscellaneous Material—Tools—Principles of Molding—Objects to be Attained in Green Sand Work—Tempering Sand and Testing Its Temperature—Effects of Hard and Soft Ramming—Use of Cross-Bars—Venting—Shrinkage of Heads—Pressure of Molds—Difference in Castings—Typical Molding Problems—Setting Cores—Duplicating Castings—Molding Machines

Part II

MIXING AND MELTING METALS: Building a Simple Mold—Building an Intricate Mold—Method of Melting in Cupola Furnaces—Operating a Cupola—Foundry Ladles—Effect of Fast or Slow Pouring—Cupola Mixtures—Chemistry of Iron—Principles of Melting—Proportions of Fuel to Iron—Sand Mixing—Cleaning Castings—Steel Castings—Shrinkage in Steel Castings—Facing Mixtures for Steel—Cleaning and Annealing Steel Castings—Brass Work—Phosphorus Bronze Mixture—Sand Used for Brass Work—Melting of Alloys—Gas and Oil Furnace—Shop Management—Division of Labor—Checking Results

FREEHAND DRAWING—Prepared by HERBERT E. EVERETT, Professor of the History of Art, University of Pennsylvania

METHODS OF FREEHAND WORK: Holding Pencil—Position—Straight Lines—Ellipses—Freehand Perspective—General Principles—Horizontal Line—Eye Level—Parallel Lines—Square—Triangles—Prism—Cylinder—Cone—Concentric Circles

MEASURING AND DRAWING OBJECTS: Testing Drawings by Measurement—Form Drawing—Value Drawing—Value Scale—Varieties of Shading—Directions of Shade Lines—Cross-Hatching

GAS AND OIL ENGINES—Prepared by LIONEL S. MARKS, S. B., M. M. E., Professor of Mechanical Engineering, Harvard University and Massachusetts Institute of Technology; assisted by H. S. McDOWELL, S. B., M. M. E., Instructor in Mechanical Engineering, University of Illinois

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PERFORMANCE DATA: Fuel Consumption—Tests for Commercial Engines—Heat Losses
CARE OF GAS ENGINES: Gas Engine Operation: Troubles, Oil, Jacket Water, Back-Firing, Care of Ignition Systems, Carbureter Adjustments

GASOLINE AUTOMOBILES—Prepared by MORRIS A. HALL, B. S., Formerly Managing Editor, "Motor Life"

Part I (Introductory—Engine Features)

FEATURES OF MOTOR-CAR CONSTRUCTION: General Outline—Engine Elements—Water Cooling—Air Cooling—Carburetion—Ignition—Lubrication—Bearings—Transmission Elements—Running-Gear Elements—Electric Lighting and Starting—Body Types

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AXLES: Front Axles: Elliott, Reverse Elliott, Lemoine, Front-Drive, Fifth-Wheel, Materials, Axle Bearing—Rear Axles: Dropped Type, Clutch Forms, Full Floating Type—Rear Axle Housings—Effect of Differentials—Rear Wheel Bearings

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TYPES: Pneumatic Tires: Types, Inflation Pressures, Changing Tires—Rims: Plain, Clincher, Quick Detachable, Demountable, Standard Sizes of Tires and Rims

GAS PRODUCERS—Prepared by LIONEL S. MARKS, S. B., M. M. E., Professor of Mechanical Engineering, Harvard University, and Massachusetts Institute of Technology; assisted by H. S. McDOWELL, S. B., M. M. E., Instructor in Mechanical Engineering, University of Illinois

PRINCIPLES, METHODS OF CONSTRUCTION: Producer Gas History—Chemical and Mechanical Process: Chemical Constituents of Producer Gas, Typical Producer, Steam Blowers, Working of Gas Producer—Gasification Losses—Representative Types of Gas Producers: Suction, Pressure, Balanced-Draft, Special Types—Producer Details—Gas-Cleaning: Defectors, Tower Scrubbers, Mechanical Scrubbers—Producer-Gas Plants: Comparison Between Producer Gas and Steam, Growth of Industry, Producing Rating—Results of Producer Plant Tests—Care of Gas Producer

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Part I

SYSTEMS OF WARMING: Composition of Atmosphere—Air Required for Ventilation—Force of Moving Air—Measurements of Velocity—Air Distribution—Causes of Heat Loss—Types of Furnaces—Location of Furnace—Smoke Pipes—Chimney Flues—Cold-Air Box—Return Duct—Warm-Air Pipes—Registers—Care and Management—Direct Steam Heating

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LOW-PRESSURE OR VACUUM SYSTEMS: Form of Heating Surfaces—Efficiency of Heaters—Pipe Connections—Pipe Sizes—Fans and Blowers—Fan Capacity—Fan Engines—Motors—Area of Ducts and Flues—Factory Heating—Exhaust Ventilation—Electric Heating—Cost of Electric Heating—Automatic Temperature Controller—Application to School Buildings—Churches—Halls—Theaters—Office Buildings

HIGHWAY CONSTRUCTION—Prepared by AUSTIN T. BYRNE, Civil Engineer, Author of "Treatise on Highway Construction"

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COUNTRY ROADS: Object of Roads—Friction—Resistance to Rolling—Tractive Power and Gradients—Location of Country Roads: Reconnaissance, Topography, Bridge Sites, Final Selection—Location of Mountain Roads: Loss of Height, Water, Alignment, Zigzags, Final Location—Construction Profile—Determination of Gradients—Width and Transverse Contour—Drainage—Culverts—Short Span Bridges—Earthwork—Roadways on Rocky Slopes—Earth Roads—Sand Roads—Sand-Clay Roads—Tools for Grading

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HYDRAULICS—Prepared by **FREDERICK E. TURNEAURE**, C. E., Dr. Eng., Dean, College of Mechanics and Engineering, University of Wisconsin

HYDROSTATICS: Units of Measure—Pressure of Water at Rest—Center of Pressure on Rectangular and Curved Areas—Buoyant Effect of Water—Bursting Pressure in Pipes

FLOW OF WATER THROUGH ORIFICES: Velocity—Measuring Water by Means of Orifice—Coefficient of Discharge—Discharge—Submerged Weirs—Weirs of Irregular Cross-sections

FLOW OF WATER THROUGH PIPES: General Principles of Flow—Friction and Velocity Head Formulas—Formulas for Quantity of Water Discharged—Hydraulic Grade Line—Siphon—Flow in Special Forms of Pipes—Minor Losses of Head in Pipe—Coefficients for Gate-Valves

FLOW OF WATER IN OPEN CHANNELS: General Formula—Hydraulic Mean Radius—Coefficients Used in Kutter's Formula—Flow Through Ordinary Sewers

MEASUREMENT OF THE FLOW OF STREAMS: Variation of Velocity—Use of Current Meter—Use of Floats—Calculating the Discharge

IRRIGATION ENGINEERING—Revised by **H. E. MURDOCK**, M. E., C. E., Head, Department Agricultural Engineering, Montana State College

SOURCES OF SUPPLY: Units of Measure—Precipitation—Surface and River Supply—Underground Supplies—Rate of Run-Off—Evaporation—Losses

DESIGN OF IRRIGATION WORKS: Gravity Works—Pumping or Lift Irrigation

CANAL SYSTEM: Design—Weirs and Dams—Wood—Dams—Regulators—Escapes—Drainage Works—Distributaries

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FLOW OF WATER IN OPEN CHANNELS: Use of Kutter's Formula—Measuring Stream Velocities: Current Meters, Meter Rating, Gaging Stations, Measuring Weirs—Francis Formula—Measurement of Canal Water

LEGAL RELATIONS—Prepared by **ELIOT N. JONES**, LL. B., and **OTIS W. RICHARDSON**, LL. B., of the Boston Bar

LAW OF CONTRACTS: Express Contracts and Contracts Implied in Law—Quantum Meruit—Express Contracts—Parties—Consent—Consideration—Statute of Frauds—Conditions—Construction of Contracts—Assignability—Avoidance—Reforming—Penalties and Liquidated Damages—Breach of Contract Operating as Discharge—Discharge by Consent—Waiver—Modification—Suretyship—Agent of Independent Contractor—Power of Agent—Liability of Principal—Duties of Agent to Principal—Delegation of Powers by Agent—Miscellaneous Matters—Architect's Position under Building Contract

LOCOMOTIVE BOILERS AND ENGINES—Prepared by
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Part I

BOILERS: History of the Locomotive—Classification—Fire-Box—Flues—Stay-Bolts—Stays—Grate—Ash-Pans—Arches—Smoke-Box—Steam-Pipes—Exhaust Nozzle—Diaphragm—Petticoat—Draft—Stack—Rate of Combustion—Steam Pressure—Heating Surface—Superheaters—Superheater Tests—Locomotive Boiler Design

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LOGARITHMIC TABLES—By courtesy of D. C. HEATH & COMPANY, Publishers

TABLES: Use of Table of Logarithms of Sines, Cosines, etc.—Use of Table of Natural Sines, Cosines, etc.—Use of Auxilliary Table for Small Angles—Tables

MACHINE DESIGN—Prepared by ERNEST L. WALLACE,
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BEARING, BRACKETS, AND STANDS: Lubrication—Materials—Practical Modifications

MACHINE DRAWING—Parts I, II, and III A prepared by
CHARLES L. GRIFFIN, S. B., Assistant Engineer, the Solvay
Process Company; Part III B prepared by C. C. ADAMS, B. S.,
Switchboard Engineer with General Electric Company

Part I

WORKING DRAWINGS: General Principles—Lines—Location of View—Cross-Section—Cross-Hatching for Different Materials—Shade Lines—Rules for Properly Dimensioning—Finished Surfaces—Indication of Materials Used—Conventional Methods—Screw Threads—Bolts and Nuts—Pipes and Pipe-Threads—Scale Drawings—Method of Indicating Long Pieces—Sketch of Detail Drawing—Tracing—Blue-Printing—Assembly Drawing—Practical Exercises in Drawing—Pillow Block—Crank—Cylinder Head

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MACHINE SHOP WORK—Prepared by FREDERICK W. TURNER, Head, Department of Patternmaking, Mechanic Arts High School, Boston; and OSCAR E. PERRIGO, M. E., Consulting Mechanical Engineer and Expert Patent Attorney

Part I

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SHOP MANAGEMENT AND RECORDS: Employment of Workmen—Records of Applicants and Employees—Time-Keeping—Methods of Paying—Order Forms—Store-Keeper

MANAGEMENT OF DYNAMO-ELECTRIC MACHINERY—Prepared by FRANCIS B. CROCKER, E. M., Ph. D., Professor of Electrical Engineering, Columbia University, New York; and C. C. ADAMS, B. S., Switchboard Engineer with General Electric Company

Part I

SELECTION AND ERECTION OF A MACHINE: Construction—Finish—Attention—Handling—Regulation—Capacity—Cost—Location—Foundation—Fixing the Machine—Mechanical Connections: Direct, Belting, Rope Drive, Toothed Gearing, Shafting—Assembly: Numbered Parts, Care of Windings, Examination, Starting Generator

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MASONRY AND REINFORCED CONCRETE—Prepared by WALTER LORING WEBB, C. E., Consulting Engineer; and W. HERBERT GIBSON, B. S., C. E., Consulting Engineer

Part I

MASONRY MATERIALS: Natural Stone—Testing Stone—Building Stone—Bricks—Concrete Blocks—Cementing Materials—Cement Testing: Chemical Analysis, Specific Gravity, Fineness, Normal Consistency, Time of Setting, Standard Sand, Form of Briquette, Molds, Mixing, Molding, Storage of Test Pieces, Tensile Strength—Constancy of Volume, Broken Stone—Mortar: Properties, Mixing and Laying, Concrete, Waterproofing, Preservation of Steel in Concrete—Fire Protective Qualities—Methods of Mixing Concrete, Steel for Reinforcing

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STATICS—Prepared by EDWARD ROSE MAURER, B. C. E., Professor of Mechanics, University of Wisconsin

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STEAM AND HOT WATER FITTING—Prepared by WILLIAM G. SNOW, S. B., Steam Heating Specialist

BOILERS: Boiler Setting and Foundations—Boiler Connections—Boiler Fittings or Trim-mings—Capacity of Boilers—Grate Surface and Heating Capacity—Coal Consumption

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STEAM ENGINE INDICATORS—Prepared by LLEW-ELLYN V. LUDY, M. E., Professor, Experimental Engineering, Purdue University

TYPES: Watt Indicator—Crosby—Tabor—American Thompson

SPRING TESTING: Testing Apparatus—Engine Connection—Continuous Diagrams—Reducing Motions—Simultaneous Cards—Detent Attachment

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STEAM ENGINES—Prepared by LLEWELLYN V. LUDY, M. E., Professor of Experimental Engineering, Purdue University

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STEAM TURBINES—Prepared by WALTER S. LELAND, S. B.,
Former Assistant Professor of Naval Architecture, Massachusetts
Institute of Technology

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STEEL CONSTRUCTION—Prepared by HENRY JACKSON
BURT, B. S., C. E., Structural Engineer for Holabird & Roche,
Architects, Member of American Society of Civil Engineers

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STEEL SQUARE—Prepared by MORRIS WILLIAMS, Expert on Joinery and Carpentry

STANDARD STEEL SQUARE: Octagon Scale—To Find Meter and Length of Side for Any Polygon—Diagram for Finding Pitches of Various Degrees—To Determine Relative Length of Run for Rafter and Hip—Use of Steel Square in Laying Out Timbers of Roofs of Equal Pitch—Finding Length of Jack Rafters—Method of Finding Bevels for All Timbers in Roofs of Equal Pitch—Finding Backing of Hip in Gable Roof

STORAGE BATTERIES—Prepared by FRANCIS B. CROCKER, E. M., Ph. D., Professor of Electrical Engineering, Columbia University, New York

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STRENGTH OF MATERIALS—Prepared by EDWARD ROSE MAURER, B. C. E., Professor of Mechanics, University of Wisconsin

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STRUCTURAL DRAFTING—Prepared by FRANK O. DUFOUR, C. E., Formerly Assistant Professor of Structural Engineering, University of Illinois

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STUDY OF THE ORDERS—Prepared by FRANK CHOUTEAU BROWN, FRANK A. BOURNE, S. M., and H. V. von HOLST, A. B., S. B., Architects

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SWITCHBOARDS, SWITCHING, AND PROTECTIVE APPARATUS—Prepared by C. C. ADAMS, B. S., Switchboard Engineer, General Electric Company

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TELEPHONY—Prepared by SAMUEL G. McMEEN, Consulting Engineer and Telephone Expert; and KEMPSTER B. MILLER, M. E., Consulting Engineer and Telephone Expert

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TINSMITHING—Prepared by WILLIAM NEUBECKER, Instructor, Sheet Metal Department of N. Y. Trade School

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TOOL MAKING—Prepared by EDWARD R. MARKHAM, Instructor in Shop Work, Harvard University and Rindge Technical School

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TRIGONOMETRY—Prepared by RICHARD J. McCARTY, Member American Society of Civil Engineers, Member American Society of Mechanical Engineers

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TYPES OF GENERATORS AND MOTORS—Prepared by W. H. FREEDMAN, C. E., E. E., M. S., Head, Department of Applied Electricity, Pratt Institute, Brooklyn, N. Y. American Institute of Electrical Engineers

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VALVE GEARS—Prepared by LLEWELLYN V. LUDY, M. E.,
Professor of Experimental Engineering, Purdue University

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WATER-POWER DEVELOPMENT—Prepared by ADOLPH BLACK, C. E., Formerly Adjunct Professor of Civil Engineering, Columbia University, New York

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WIRELESS TELEGRAPHY—Prepared by CHARLES G. ASHLEY, Electrical Engineer

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DEFINITION: Bill of Exchange—Foreign and Inland Bills—Promissory Note—Certificate of Deposit—Bonds as Negotiable Instruments

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COMMON LAW PLEADING AND PRACTICE—Prepared by ROBERT W. MILLAR, LL. B., Lecturer, Northwestern University Law School

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CONFLICT OF LAWS—Prepared by EDWIN MAXEY, Ph. M., M. Dip., D. C. L., LL. D., Professor of Public Law and Diplomacy, University of Nebraska

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CONSTITUTION OF THE UNITED STATES—Prepared by DAVID K. WATSON, A. B., LL. B., LL. D., Former Attorney General of Ohio and Member of Congress

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CONTRACT (LAW OF)—Prepared by HENRY C. JONES, A. B., LL. B., Assistant Professor of Law, The George Washington University

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CONTRACTS AND AGENCY (SUMMARY)—Prepared by JOHN A. CHAMBERLAIN, A. B., LL. B., Formerly Lecturer on Suretyship, Western Reserve University Law School

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NATURE OF CRIME: Public Wrong—Punishable by State—Criminal Process—Crime Distinguished from Tort—Consent of Injured Party—Fault of Injured Party—Condonation—Participation of Public Officer

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EVIDENCE (LAW OF)—Prepared by GEORGE E. CHIP- MAN, A. M., LL. B., Professor of Law, The John Marshall Law School, Chicago

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WITNESSES: In General—Prior Conviction—Mental Incapacity—Husband and Wife—Lack of Religious Belief—Privileged Communication—Attendance of Witnesses—Depositions—Bills in Equity For Discovery—Oath—Examination—Privilege against Self-crimination—Objections and Exceptions—Offers of Testimony—Interpreters—Refreshing Memory—Impeachment—Corroboration—Relevancy—Negative Evidence—Evidence of Similar Facts—Character—Remoteness—What Witness May Relate—Statements of Others as Original Evidence—Statements by Telephone—Phonographic Records—

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ORRIN N. CARTER, LL. D., Chief Justice of the Supreme Court of
the State of Illinois

MANDAMUS: Definition and History—Character and Scope—Parties Plaintiff—Parties Defendant—Ministerial and Discretionary Duties—Against Courts and Judicial Officers—Against Executive Officers—Against Private Corporations—Pleading and Practice

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MINOR FEDERAL COURTS: Court of Claims—Court of Customs Appeals—Commerce Court—Circuit Courts of Appeals

SUPREME COURT: Jurisdiction, Procedure—Recent Act Relating to Judiciary

FIRE INSURANCE LAW (INCLUDING STANDARD POLICY)—Prepared by EDWARD R. HARDY, Ph. B., New York Fire Insurance Exchange. Lecturer on Fire Insurance, New York University

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INTRODUCTORY: Policy a Contract—Insurable Interest—Early Policy Forms: Proposal, Brief, Sun Fire Office, Insurance Company of North America, United States Fire Insurance Company—Massachusetts Standard Policy—Uniform Policy

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GUARANTY AND SURETYSHIP—Prepared by WM. UNDERHILL MOORE, A. M., LL. B., Professor of Law, University of Wisconsin Law School

REQUISITES OF SURETY'S CONTRACT—STATUTE OF FRAUDS: Real and Personal Suretyship—Suretyship a Relation—Proper and Improper Suretyship—Statute of Frauds—Special Promise to Answer for Another's Default—Two Obligations, a Principal Debt and a Special Promise—Obligation to Be a Guaranty—The Obligation to Indemnity—Insurance Contracts—Exceptions to Tests

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INSURANCE LAW—Prepared by LEWIS A. STEBBINS, LL. B., General Counsel, National Life Insurance Company of the United States of America

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PERSONS (LAW OF)—Prepared by DONALD L. MORRILL,
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DEPARTMENT STORE ACCOUNTS—Prepared by CHARLES A. SWEETLAND, Consulting Accountant

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PUBLISHERS' AND PRINTERS' ACCOUNTS—Prepared by CHARLES A. SWEETLAND, Consulting Accountant

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SURDS: Addition—Subtraction—Multiplication—Division—Involution and Evolution

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